DEFENSE INDUSTRY BULLETIN

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The purpose of the *Bulletin* is to serve as a means of communication between the Department of Defense (DOD) and its authorized agencies and defense contractors and other business interests. It will serve as a guide to industry concerning official policies, programs and projects, and will seek to stimulate thought by members of the defense-industry team in solving the problems that may arise in fulfilling the requirements of the DOD.

Material in the *Bulletin* is selected to supply pertinent unclassified data of interest to the business community. Suggestions from industry representatives for topics to be covered in future issues should be forwarded to the Editor. Telephone queries: (202) OXford 5-2709.

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About the Cover

Artist's concept shows SEALAB III habitat and transfer capsule. Experiment in sea-bottom living begins the middle of October.

More Defense Contractors Augment Income Through Value Engineering Proposals

R. E. Biedenbender
R. H. Kempter

Back in the cost-plus-fixed-fee days, when a defense contractor submitted a cost reduction change requiring government approval, he frequently found his fee cut as a result. Needless to say, under this type of incentive, DOD received few proposals of this kind.

This negative incentive was replaced by a positive incentive with the adoption of value engineering contract incentive clauses, now provided for in the Armed Services Procurement Regulation (ASPR), Section I, Part 17. These clauses invite contractors to submit sound Value Engineering Change Proposals which require a contract change, and to benefit from such action by sharing the resulting savings with the Government.

Current value engineering incentive clauses permit contractors to receive up to 75 percent of the net savings on a current contract, 20 to 40 percent of savings on follow-on contracts (even though another contractor gets the bid), and 10 percent of the collateral savings (savings in government operating expenses) for an average year.

Value engineering contract incentive provisions provide a new avenue for the defense industry to augment income, and this avenue does not require significant investments in capital equipment or labor. DOD also benefits, since its share of Value Engineering Change Proposal (VECP) savings could not otherwise be generated. Thus the DOD Value Engineering Contract Incentive Program offers unique joint benefits to Government and industry.

How well are these incentives working? Let us look at the record. Since emphasis was placed on value engineering contract incentives in FY 1965:

- DOD's estimated share of savings exceeds $150 million.
- Over 3,400 contractor-initiated VECPs have been approved.
- Contractors average 43 cents income for each dollar saved by DOD.

More specifically, let us examine the progress from FY 1967 to FY 1968:

- Estimated savings to DOD in FY 1968 reached $51.8 million, an increase of 33 percent over the previous year.
- The number of VECPs approved in FY 1968 reached 985, an increase of 23 percent over FY 1967.
- The FY 1968 VECP acceptance rate reached 60 percent, up 5 percent over FY 1967.
- Only 39 percent of the VECPs on hand at the end of FY 1968 were still in process after 60 days, compared to 65 percent at the end of FY 1967.

Thus dollar savings and number of approvals are growing, while government processing time has decreased significantly.

Another view of this progress can be obtained by examining patterns of increasing contractor participation. The number of contractors participating with High-Value VECP approvals (a VECP with estimated net savings exceeding $50,000) increased from 55 in FY 1967 to 64 in FY 1968. Several contractors, successful in FY 1967, increased their efforts substantially in FY 1968. One had 11 High-Dollar approvals with an estimated income of $1.95 million in FY 1967, and 19 High-Dollar approvals with an estimated annual income of $4.7 million in FY 1968. Another had 12 High-Dollar approvals in FY 1967, and 15 in FY 1968 with total estimated income of $3.8 million.

A Specific Example

Let us look in detail at a motivated contractor's VECP record. The following statistics, covering the period from July 1967 to May 1968, show the results obtained by Honeywell Ordnance Division, where significant management emphasis has been placed on the generation of VECPs:

Submissions:	116
Approvals:	57
Pending:	39
Submission Rate:	5 per month
Approval Rate:	
Quantity-wise:	69 percent
Dollar-wise:	70 percent
Average Processing Time:	
Submission to Approval:	92 days
Approval to Cost Modification:	207 days
Dollar Value (in millions):	
Total Instant Contract Savings:	$3.877
Royalties Received:	$0.415
Royalties Claimed and Due:	$0.722
Pending VECPs:	$2.270

This record is of even greater interest when it is realized that Honeywell has sold VECPs to all three Services, with virtually the same acceptance rate, on a variety of items including mechanical and electronic fuzing, torpedoes, and rocket air drop munition systems. The Honeywell experience indicates that an enterprising contractor can augment income significantly by generating a high volume of sound VECPs.

Room for Growth

While the current progress is encouraging, there is still a vast untapped potential for benefits to DOD and industry through VECPs. An extensive review of the DOD Value Engineering Contract Incentive Program indicates there is an immediate

potential for savings of $200 million annually through VECPs.

There is still wide variation in understanding and support given the Value Engineering Program by defense industry top managemet. An analysis of DOD VECP Reports for FY 1968 shows that 10 participating contractors generated estimated savings to DOD from High-Dollar VECPS in the amount of $29.4 million. These successful contractors will share as estimated $15 million in additional income. On the other hand, another group of 10 major defense contractors, who received a total of $2.584 billion in contract awards, produced no savings. It is difficult to believe that no High-Dollar VECP opportuniities existed in the volume of business received by the latter group of contractors.

Where To Look

After the management decision to commit resources to the VECP opportunity has been made, sound VECPs must be generated. Figure 1 is taken from a 1965 Genesis Study and illustrates the areas of opportunity which permitted generation of VECPs. It indicates that VECPs can be successfully developed over the entire spectrum of design and manufacture. Other contractors have produced excellent results in the follow-on support phase. In the case of Honeywell cited previously, emphasis has been placed on submission of sound, well developed and documented VECPs. The company frequently rejects "marginal" VECPs in-house. This policy has paid off with an acceptance rate of 70 percent compared to the 60-percent DOD average. Figure 2 indicates some common causes for rejection of VECPs and pitfalls to be avoided in submitting viable VECPs to DOD activities.

Action Needed To Increase Benefits

A 1968 Logistics Management Institute (LMI) study of contractor value engineering programs made four recommendations for expanding benefits to DOD and industry through VECPs:

- That DOD continue its educational, training and promotional efforts in the DOD VECP Program for all concerned personnel at all levels of DOD and the defense industry.
- That DOD improve VECP processing time.
- That DOD closely monitor experience with the ASPR provisions relating to value engineering.
- That defense industry intensify its educational, training and promotional efforts in the DOD VECP Program.

These recommendations were essentially substantiated by several independent government studies. Resulting DOD actions include the second DOD Value Engineering In-House Conference held in September 1967. Approximately 400 DOD middle managers spent three days exchanging views on policies and progress of the Value Engineering Program. Virtually all the key logistic officials in the Office of the Secretary of Defense, the Military Departments and the Defense Supply Agency participated. A special three-day executive seminar was established and has been held for key DOD managers in 12 different locations during the course of this year. These courses are designed to meet the need for understanding and support of middle management involved in contracting, logistic support, engineering, etc.

Actions have also been taken within DOD to expedite VECP processing. These actions include the establishment of an improvement goal for each Service on the percentage of VECPs held over 60 days. Progress is being measured quarterly. Significant improvement was achieved in FY 1968, as cited earlier in this article. The DOD Value Engineering Council holds monthly reviews of the five oldest VECPs on hand in each Service. New configuration control directives, setting target dates for VECP processing and handling according to priorities, have been issued.

With regard to defense contrac-

Factors Leading to Value Engineering Changes DOD Contractors

(116 Class I Changes)

Factor	No. Times Cited	* Total $ Saving	Factor
Excessive Cost	75	$ 5,736	Excessive Cost
Questioning Specification	53	5,453	Questioning Specification
Additional Design Effort	42	4,938	Advances in Technology
Advances in Technology	33	1,646	Additional Design Effort
Feedback from Test/Use	21	860	Change in User's Need
Change in User's Need	16	832	Feedback from Test/Use
Design Deficiencies	11	421	Design Deficiencies
Totals	251	$19,886	

* $—Thousands

Figure 1

tors, additional actions are underway. The heads of all major defense corporations are advised annually of progress of the program during the past year. The Defense Contract Administration Services Office, in conjunction with the Society of American Value Engineers, has been holding a series of value engineering executive seminars nationwide to acquaint industry with the VECP opportunity. Also, key officials of the Office of the Secretary of Defense are visiting selected contractors to discuss value engineering contract incentives informally with contractor top management. The Military Departments have activities of a similar nature.

The Honeywell Formula

The LMI study, previously mentioned, indicated that industry must also educate its personnel on the VECP opportunity. While DOD is assisting this effort through media such as the DCAS-SAVE value engineering seminars and visits to contractors, ultimately industry must recognize the VECP opportunity and organize to capitalize upon it.

The Honeywell Ordnance Division formula for successful VECP results has 10 key points:

- **Know Your Market.** Recognize the opportunity provided by ASPR 1–17 (Revision No. 23) and its impact on your own sales objectives.
- **Plan Your Program.** Draw up and schedule a value engineering plan of attack. Put value engineering on an equal business footing with your other key projects.
- **Execute Your Plan.** Make a commitment of manpower and funds at the top management level in accordance with corporate profit objectives.
- **Establish Your Own Professional Value Engineering Staff.** Use it as a catylist to generate sound results through training and consultation.
- **Motivate Your Planners and Doers.** Educate personnel at all levels in the cost reduction potential of value engineering and the means of applying value analysis techniques to in-plant projects.
- **Involve Your Line Management.** Let project supervision participate in establishing cost reduction goals. Hold them responsible for measuring results and reporting progress.
- **Work Your Teams.** Use your trained manpower to form value engineering task teams and systematically eliminate unnecessary costs, project by project.
- **Tailor Your Results.** Write VECPs which help your customer attain his cost goals while maintaining or improving upon schedule, quality and performance.
- **Market Your Product.** Put the emphasis on selling, installing and servicing a VECP that its profit value deserves.
- **Realize Your Benefits.** Everybody wins when government-industry teamwork culminates in the adoption of an incentive VECP: the customer and the taxpayer through reduced costs; corporate management and the stockholder through incentive sharing of the dollars saved.

DOD CONTRACTOR VECPs—FY 1967

Reasons Given for Rejection of 134* VECPs Order of Frequency

Order of Frequency	Reason for Rejection	No. of Citations	Percent Citations
1	Item or System Performance Adversely Affected	48	35.8
2	Not a VECP	26	19.4
3	Technical Supporting Information Incomplete or Inaccurate	23	17.2
4	Proposal Initiated or Developed by the Government	10	7.5
5	No Reason Given	7	5.2
6	Cost Analysis Incomplete or Inaccurate	5	3.7
7	Qualification Test Required	4	3.0
8	Contract Fulfilled Before Proposal Evaluated	4	3.0
	Other	7	5.2
		134	100.0

* Estimated total net savings before sharing: each VECP at least $50,000.

Data Source: DOD VECP Report—FY 1967

Figure 2

LMI Suggestions

The validity of the Honeywell formula is particularly interesting in the light of these LMI findings in its 1968 study:

- **Top industry management does not always fully understand the intent and objectives of the DOD VECP Program and, consequently, sometimes fails to give it full support. Aggressive, successful contractor VECP programs were usually found where top management does fully understand the program's objectives.**
- **Where contractors focus their attention on the "savings sharing" potential to themselves from the DOD VECP Program and relate these shares to augmentation of their income and to return on their value engineering investment rather than to "cost reduction" to DOD, top management support was usually not a problem. For example, one large contractor, which**

had received over $1 million in savings shares from its accepted VECPs, noted: "The $1 million plus profit enhancement is equivalent to $20 million in new business."

- Some contractors appear to put too low a level of investment into their overall value engineering effort. For example, a National Aerospace Services Association survey showed that the level of value engineering investment ranged from 3/100 to 1/10 of 1 percent of annual sales in five member companies (a 1963 report indicated that 1/10 to 1/2 of 1 percent of total annual sales appeared to be a reasonable level of investment for value engineering).
- Some contract administration and comptroller personnel in defense industry do not fully understand the intent and objectives of the DOD VECP Program and, consequently, fail to pursue it aggressively and fail to give proper visibility to industry benefits realized from the program.
- Top defense industry management support of the DOD VECP Program would probably increase if contractors would relate their "savings shares" to augmentation of their income and to return on their value engineering investment, rather than to "cost reduction" to DOD.

In the specific area of industry VECP preparation and processing through DOD, LMI recommended that greater industry emphasis be placed upon such matters as:

- Reduction of length of VECP processing time within industry itself.
- Improvement of the quality of industry VECPs, with more complete supporting technical information and cost analysis.
- Establishment of early and continuing VECP communications channels with DOD counterparts.

This last point deserves emphasis. Historically, industry VECP communication has been mainly to DOD working levels. There is now growing recognition in industry that the VECP income potential warrants top level communication between key contractor and government personnel on specific contracts and programs to insure mutual understanding of the benefits of VECPs, to discuss expected volume of VECP submissions, and to agree on any local ground rules necessary for their processing. Such a step is particularly useful at this time, since the relatively recent development of current ASPR provisions relating to value engineering means that many people in both industry and Government are only now becoming acquainted with the benefits and use of this new technique.

Check Yourself

As growing understanding of the techniques and benefits of value engineering contract incentives causes more and more defense contractors to take advantage of this new opportunity to increase income, interest is growing in the basic ingredients for a successful VECP program. The American Ordnance Association is currently planning a survey of successful contractors to specifically indentify management practices which seem to enhance chances for success, and will hold a symposium in October on this subject. This activity should be of great benefit to industry and Government.

Meanwhile, contractors may wish to check their programs against the following checklist, compiled by DOD personnel as a result of many informal discussions with successful contractors:

( ) Do you set company or division goals for VECP income?

( ) Are VECP goals established for line department and program managers?

( ) Does top management review VECP income and approve value engineering operating goals and budgets?

( ) Does company top management meet with key customer personnel to agree on VECP goals and processing on major contracts and programs?

( ) Do personnel, such as marketing, work on the "team," and do they receive credit for VECPs approved, or are they "penalized" due to reduced credit for reduced contract price?

( ) Do your negotiators understand the ASPR provisions relating to value engineering? Do you request and negotiate for fair terms?

( ) Do you place provisions for value engineering in your subcontracts?

( ) Is VECP income identified separately by accounting so that Renegotiation Board review is eased and top management can recognize the contribution of value engineering?

( ) Do you assign resources to the development of specific VECPs?

( ) Does your method of operation allow minimum time to develop a VECP and to obtain internal company approval prior to submission to the Government?

(*Continued on page 16*)

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Aquanauts To Explore Ocean Bottom

[*Editor's Note: This article was prepared by the* Bulletin *staff based on fact sheets on the SEALAB III project released by the U. S. Navy Deep Submergency Systems Project, 6900 Wisconsin Ave, Chevy Chase, Md. 20015.*]

What is the world like on the ocean floor, 600 feet below the surface of the sea?

To answer that question, 40 U.S. and foreign Navy and civilian acquanauts will live in a sea-bottom habitat off the shores of San Clemente Island, Calif., beginning this month. They will work in the open ocean area around their undersea quarters, and will conduct scientific experiments.

The objective of the Ocean Floor Program experiment, dubbed SEALAB III, is to gain knowledge and know-how pertinent to the adaptation of man to the deep sea environment at ambient pressure. The primary interest of the Defense Department and the Navy in the Man-in-the-Sea experiments is to provide a capability for rescue and salvage operations, maintenance of bottom-mounted equipment, use of the continental shelf for military operations associated with, for example, mine defense and amphibious assault. However, this program has vast secondary peaceful gains for the nation. Technology gained in Man-in-the-Sea will hasten and make possible exploitation of the world's continental shelves for food, minerals and recreation. The economic and scientific potential of the sea is as great or perhaps greater than that of land surfaces.

By 1970, the U.S. Navy plans to have diver-aquanauts living in advanced sea habitations on the continental shelves for 30 days or more without coming to the surface. The depth capability of the aquanauts will ultimately be extended from the average 600–foot depths of the shelves down to the as yet unknown, physiological limits of man.

Five teams of eight men each, including civilian scientists, will occupy the underwater habitat alternately for 12–day periods during the 60–day experiment. The divers will engage in activities ranging from assembly of a house on the ocean floor to studies of how light attracts fish.

Fifty-four men—Americans, British, Canadian and Australian—have been undergoing training for several months to take part in the experiment. Forty aquanauts will work on the bottom; the remaining 14 will serve as surface support divers and will provide a ready reserve of trained and qualified divers.

Commander M. Scott Carpenter, the former astronaut who was team leader for 30 days during the 1965 SEALAB II operation, will serve as senior aquanaut of SEALAB III. He will direct the activities of the five team leaders and will make periodic visits to the teams during their stay on the sea floor.

The Ocean Floor Program consists of tasks in six general areas:

- Oceanography.
- Engineering.
- Construction.
- Salvage.
- Biology.
- Human performance.

A number of U.S. Navy activities, the Department of Interior's Bureau of Commercial Fisheries, and the Philadelphia General Hospital are involved in developing these tasks.

The Oceanography Task

Within the oceanography areas, experiments will be conducted in physical and biological oceanography, the use of marine mammals, geology and bio-acoustics.

In the physical oceanography task, devices will be installed on the ocean floor, including current meters, thermographs, a tide gauge, an underwater "weather station," temperature recorder, a bio-luminescene meter, a radiance meter, a ripple measuring comb, and a salinity meter. The underwater weather station, which is in addition to other measuring devices, will record temperature and current data at three levels above the bottom at least once a minute. A falling-ball turbulence study, developed by internationally known French oceanographer, Captain Jacques Cousteau, will investigate turbulence and eddies in the ocean by plotting the impact location of negatively buoyant balls released from a given height above the ocean floor.

Oceanographic measurements will also be made from the surface and in the water column.

Aquanauts from the Bureau of Commercial Fisheries will conduct work in the areas of marine biology and ecology. They will create a cadre of personnel trained in saturation diving techniques and familiar with engineering design, support, and operations on the sea floor. Their work will also provide a preliminary assessment of the research value of observation and experimentation in the deep-ocean environment. Further development of the undersea laboratory concept as a research technique for oceanographic and fisheries work is expected to yield large benefits to marine resource development.

In their task, the diver-scientists will undertake a variety of short-term experiments, including lobster transplant studies, light attraction studies of fish and invertebrates, and observations of fish species behavior and interaction. They will also study light production by biological organisms.

Aquanauts will study marine mammal behavioral and physical capabilities to help develop training techniques. During SEALAB II in 1965, an Atlantic bottlenose porpoise named Tuffy was used to demonstrate the feasibility of employing a marine mammal to aid a lost aquanaut, and to deliver tools, messages and other objects. Two wild sealions also be-

friended the crew of SEALAB II; they could be called by the aquanauts and fed by hand, and they surfaced in the well of the habitat to breath the helium-oxygen atmosphere before returning to the surface.

Tuffy returns to the Man-in-the-Sea program in SEALAB III, along with another porpoise and two sealions. They will be used to search for and, if necessary, rescue lost aquanauts, as well as for delivery of small items, propulsion aid, and to assist in underwater photography. Small items, such as tools and specimen containers, will be attached to a mammal's harness for delivery between the habitat and surface, habitat and divers, or between two or more divers working in open water. During the tests, an aquanaut will also use an acoustic device to signal he is "lost." The mammal is expected to respond by picking up a tethered line at the habitat and carrying it to the aquanaut.

The geological oceanography program will observe sedimentological processes, such as transport, scour and structural settlement, which heretofore have been unattainable by conventional divers. Current measurements and time-lapse photography will be used to support the sediment transport studies.

During SEALAB III, efforts will be made to identify sounds produced by marine organisms. This work will involve placing hydrophones on the bottom 50 and 100 feet from the habitat, and recording under "quiet" conditions as well as normal sub-surface operating conditions.

Engineering Data Collection

Work in the engineering phase involves communications, evaluation of exposure suits and face masks, and extensive engineering evaluation of the sea floor habitat and systems.

The effectiveness of various types of voice communications (such as between aquanauts in the water and in the habitat) in SEALAB III type operations, where man breathes speech-distorting helium, will be studied.

Exposure suits, with the aquanauts heated by circulating warm water or electric "blanket" suits, will be tested in an effort to extend diver working time in the open sea. Similarly, tests of special face masks and helmets will be conducted.

Data will be collected to measure the effectiveness of various sea-floor habitat systems and life-support equipment. This data will provide parameters and criteria for future sea floor installation designs. Major areas being studied are structural, such as ports, hatches, access openings, drains and ballast; systems, such as the ballasting system, pressure control, plumbing and food storage; and habitability, such as space utilization, safety and comfort.

Construction on the Ocean Floor

The construction experiment in SEALAB III will help determine the ability of divers to assemble structures on the ocean floor. In this experiment four aquanauts will assemble and repair a storage station near the sea floor habitat.

The aquanauts will use an underwater trolley system, with a variable buoyancy pod containing a hydraulic winch, to move prefabricated sections of the structure along the ocean floor. The sections will be assembled with quick-connect/quick-release fasteners. A buoyant "chandelier" will be suspended over the structure to provide area lighting.

The complete station will be 10 feet high and have a 10-foot diameter with the bottom open to the sea to provide an entryway. A grillwork in part of the opening will serve as a floor. After the structure is assembled, it will be blown dry and outfitted with shelves, interior lights, and other accessories for use as a repair and storage station.

Emphasis on Underwater Salvage Techniques

A main purpose of the Man-in-the-Sea effort is to improve underwater salage techniques.

A chemical bottom overlay spray will be tested in an effort to reduce bottom turbidity to enable more effective work by divers.

Four salvage lift systems will be tried:

- A small, rugged, self-contained lift system consisting of a 70-cubic-foot buoyancy pontoon and a hydrazine gas generator.
- An 8.4-ton lift collapsible pontoon inflated by surface supplied air.
- A Hunley/Wischoefer Lift System which consists of a 25-ton salvage padeye, a variable buoyancy messenger buoy, and a remote coupling device for attaching the lifting point being salvaged to the lifting wires of a surface ship.
- A small, self-contained variable buoyancy system including attachments for moving small objects, 100 to 200 pounds, along the bottom.

Four improved diver tools will be tested in SEALAB III: an explosive cable cutter, an explosive stud driver, an electric-powered hand tool, and oxy-arc burning equipment. The electric hand tool is a multi-purpose device which works on the impact principle. This will be especially useful where no firm surface is available to help the diver brace himself against the effects of conventional torque tools. Problems of providing oxygen through hoses for deep-depth use of oxy-arc burning tools also will be examined.

Improved methods of locating objects on the ocean floor will be tested, among them a "spider web" of light grid lines carried between aquanauts, and a new type of circling line. These tests will help divers locate objects within an area when working in the murky, deep-depth bottom environment.

Observation of Crew Performance

During previous saturation diving experiments, aquanauts have developed infections, and microorganisms have been transferred among personnel. Now scientists wish to determine the susceptibility or resistance to infection of man in the sea-floor environment.

The electrocardiogram telementry task will study cardiac performance and body temperatures at different depths, water temperatures, and conditions of physical and mental stress. Cardiac performance will be monitored by telemetering and electrocardiogram while the divers are in the water and in the hibitat.

The heated diver's dress and thermal balance phase of the biology program will investigate body heat loss due to the helium-oxygen atmosphere of the habitat, and the effectiveness of protective thermal equipment when the aquanaut is in the water.

Investigations will be conducted in sleeping habits of aquanauts exposed to prolonged living in the high-pressure, helium-oxygen, semi-isolated, and stress conditions of the SEALAB.

Experiments relating to speech and

manual dexterity will be directed toward determining whether there is a performance loss at various depths, with observations being made at the surface, 8 feet, 200 feet, 300 feet, 400 feet, 450 feet, and 600 feet. The performance being observed will include helium speech, fine and gross manual dexterity, and associative memory.

Human performance will be measured during execution of various work and salvage operations. The emphasis is on developing procedures and work doctrines, rather than testing equipment.

Similarly, construction tasks will measure diver performance during underwater use of hand tools, moving and manipulating heavy pieces of equipment, and extensive coordination among aquanauts and between aquanauts and surface support personnel.

Experiments will test underwater visibility of aquanauts on the open sea and in the habitat.

A crew observation experiment seeks to develop a better understanding of behavior of individuals and crews in special environments of staturation diving and the sea-floor habitat. Some of the questions to be answered are:

- How does man respond to this environment?
- What kind and how much work can he best perform?
- How will he get along with other divers?
- What will be his relationship to surface life?
- How will he react emotionally?
- How do his reactions compare with those of other men exploring unusual environments, such as outer space, the Antarctic, Mount Everest, and other remote areas.
- How should SEALAB crews be organized?

During SEALAB III the aquanauts will be observed by closed-circuit television, monitored by open microphone, and extensively interviewed in an effort to answer these and other questions.

In addition to the Ocean Floor Program described here, several related programs will be conducted in the fields of physiological testing, atmospheric control, aquanaut equipment, and human engineering evaluation.

SEALAB III Habitat

The habitat for SEALAB III, a modification of the habitat used during SEALAB II, is a non-propelled submersible, constructed and shaped much like a submarine. It is designed as a pressure vessel to be lowered and emplaced on the ocean floor. It has positive stability on the surface, and while submerging or surfacing. Water ballast tanks are used to control positive and negative buoyancy.

The living compartment of the habitat is cylindrical, 12 feet in diameter and 57 feet long. Two rooms, 8 feet high and 12 feet square are attached to the bottom of the hull of the habitat, one forward and one aft of the craft. The after room will be used as a diving station. It houses diving lockers, diving gear, hot showers, and the open hatch for access to the sea. The forward room is planned for use as an observation and storage compartment. It is fitted with large portholes and a refrigerator-freezer unit. It also has an emergency escape hatch.

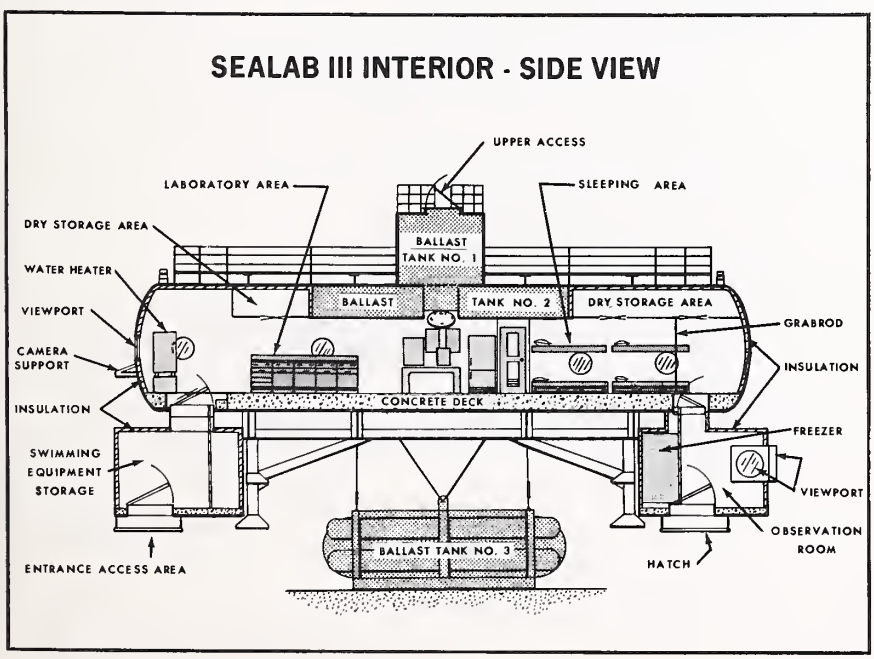
From the diving station compartment, the aquanaut climbs a ladder through a hatch to the main living compartment. The living compartment can be sealed off from the diving station to reduce humidity.

The living compartment is divided into a laboratory, galley and bunkroom, as one goes forward from the entryway. Eleven viewing ports are provided on the hull, each protected by a light outboard cover and a pressure inboard hinged cover.

Electric power, fresh water, communications, television links, and other life-support needs are supplied through an umbilical from a surface support vessel stationed almost directly above the underwater habitat. Emergency life-sustaining supplies are stored aboard the habitat.

The atmosphere in the living compartment will be kept at 206 pounds per square inch absolute, corresponding to 430 feet of water. It contains about 92 percent helium, 6 percent nitrogen, and 2 percent oxygen. Replenishment gas is brought in through the umbilical from the support ship, or from external bottles stowed on the habitat. The atmosphere in the living compartment is charged on the surface and during lowering to the sea floor. Sixteen external bottles will contain enough breathing gas to sustain eight men for 15 days. Carbon dioxide is removed from the atmosphere by a device known as a scrubber, which contains the chemical lithium-hydroxide. Charcoal is used to remove odors. Both chemicals must be replaced as they are used.

Electric dehumidifiers control the humidity, and heat is supplied by convection heaters. A radiant system with thermostats maintains habitat temperature at about 92 degrees. Although this degree of heat would be excessive at the surface, it is required in the habitat because body heat loss in the helium atmosphere is greater than in normal air.



Support Operations

The staging vessel to be used in support of the SEALAB III operation is a modified medium rocket landing ship (LSMR), named Elk River (IX 501). This class of ship was originally designed to support landing operations, but its modifications will enable the vessel to support all aspects of in-place testing at the San Clemente Island Ocean Engineering Test Range.

During the SEALAB III experiment, the ship will be held in a tight moor, vertically over the bottom location of the habitat. The ship will be tethered by five mooring lines, one from each quarter and one lead directly over the bow. A tensiometer connected to each leg will indicate the tension at all times.

The vessel is outfitted with two deck decompression chambers, each designed to support four divers during the six-hour decompression period needed to return saturated divers from the pressure found at 600 feet to normal atmospheric conditions.

A pressurized elevator system, called a Personnel Transfer Capsule, will transport divers from the ship to the bottom habitat. The capsule will mate with the deck decompression chambers so that at all times, whether topside or at the 600-foot operating level, the aquanauts can be kept at pressures equivalent to the ambient ocean pressures at the bottom.

The Elk River will also provide storage for the various compressed gases needed. Because of huge requirements for helium, a recovery unit aboard the vessel will be evaluated for installation on other Navy diving ships.

Two portable vans are installed topside, one a command center, the second a medical van. These will be the nerve centers of the SEALAB III operation. They will bring together in one location all the critical measurements affecting the safety and well being of the aquanauts. The ship was also lengthened 21 feet; a center well was installed; a 60-ton gantry crane services the well area and stern; eight-foot sponsons added to the sides of the ship provide needed space and stability; and, finally, an active positioning system will orient and hold the ship for operations of short duration not requiring an elaborate mooring system.

Man-in-the-Sea Began on Land

The Man-in-the-Sea program began in 1958 with Project Genesis, a six-year series of dry-chamber, high-pressure experiments which led to the development of a new diving concept in saturated diving. This concept has given the Navy the potential for extended underwater experiments. It was used by the American investigator Edwin A. Link and by Jacques Cousteau in their underwater living experiments.

The experiments proved that the length of time required for decompression was not invariably related to the length of the dive. For the first time, it was demonstrated that a diver will absorb only a specific amount of gas at any given depth, the amount reaching a maximum after 24 hours of exposure to pressure. Thus, after 24 hours in the ocean depths at pressure, the diver's tissue and blood have reached equilibrium with the breathing gas, and he is fully saturated. Once fully saturated, his decompression schedule remains constant regardless of how long he may stay beneath the surface. This awakened scientists to the possibility of men living underwater for extended periods of time.

The Navy successfully tested its laboratory results in open-ocean experiments SEALABs I and II. These projects conclusively demonstrated the possibilities of living underwater.

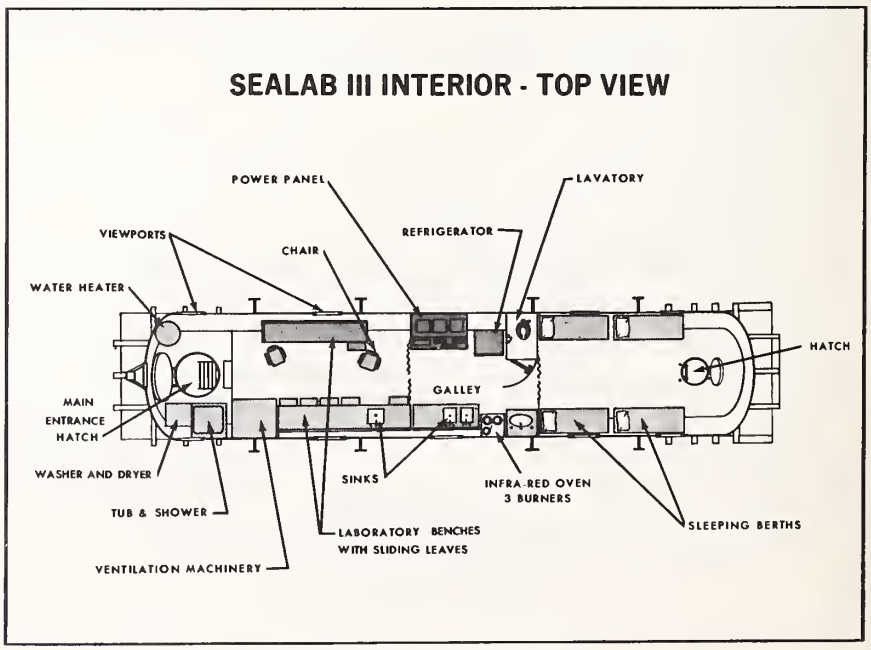
SEALAB I was held during July and August 1964 in 193-foot deep waters 30 miles southwest of Bermuda. Four aquanauts lived underwater for 11 days without significant physiological or psychological change. SEALAB II was held off the coast of La Jolla, Calif., in the summer of 1965 at a depth of 205 feet. In this experiment. three teams of 10 aquanauts lived on the ocean bottom for 15-day periods.

Intensive Training Precedes "Down Day"

For several months, the U.S. and foreign Navy and civilian SEALAB III aquanauts have intensively trained to improve their skills as divers and in a number of specialized fields. Their underwater work included projects in biology, ecology, bio-acoustics, physical oceanography, geology, bio-luminescence, construction, salvage, photography and communications.

Most of the Navy aquanauts entered SEALAB III training from diving assignments in the Fleet, assignments as ship's divers, underwater demolition teams, explosive ordnance disposal and salvage. Other trainees had previous Navy or civilian diving experience.

Personnel of the U.S. Navy in the program are all qualified first class divers, having attended the 26-week Deep Sea Diving course in Washington, D.C. This course qualified the divers in the use of Scuba gear for



depths to 130 feet using compressed air, and in the use of "hard hat" diving to depths of 320 feet using a helium-oxygen breathing mixture. The navy divers from Britain, Canada and Austrialia had similar training.

Most of the aquanauts also underwent specialized training at the Naval Underwater Swimmers School, Key West, Fla., at the Navy Experimental Diving Unit in Washington, and the Deep Submergence Systems Project Technical Office (DSSPTO) in San Diego, Calif.

At the Underwater Swimmers School, the divers attended a two-week course in the use of Scuba gear, breathing helium-oxygen to depths of 150 feet. During SEALAB III the aquanauts will work in the water around their habitat using a Mark VIII semi-closed Scuba, which provides helium-oxygen breathing gas from back bottles or through a hose from the habitat. The semi-closed system purifies and recirculates about two-thirds of the breathing mixture and exhausts the remainder.

Training at Key West was designed primarily to aclimatize the aquanauts to work while using the semi-closed Scuba. Technical training in the use and maintenance of the Mark VIII equipment was taught at the Experimental Diving Unit and DSSPTO.

At the Experimental Diving Unit the men made dives in dry and wet chambers to simulate deep-ocean pressure. These "dives" determined if the aquanaut candidates were psychologically and physiologically suited for saturation diving. In these dives the men were taken to various simulated depths, eventually spending at least 24 hours at the 450- or 600-foot level. They were then slowly returned to surface pressure, undergoing a carefully calculated decompression to prevent their contracting the deadly "bends."

In addition to diver and equipment evaluation aspects of the chamber dives, each Navy aquanaut was taught to operate a saturation diving system similar to the one which will be used in SEALAB III. That system is, itself, a prototype of an advanced diving complex which will be used in the Fleet.

Certain SEALAB III aquanauts received special training to prepare them for specific tasks in the ocean bottom program. For example, aquanaut photographers will install and maintain a special camera and lights package at the SEALAB III test site. They practiced servicing and operating the equipment in the actual environment they will encounter in the open ocean. Hospital corpsmen learned to use special equipment for bio-medical analysis in the SEALAB III environment, and to monitor the seafloor habitat's atmosphere.

Prior to the start of SEALAB III experiment, the men will receive intensive training at the DSSPTO, "homeport" and primary training facility for U.S. Navy aquanauts. This will include daily open-sea diving exercises, instruction in the operation of SEALAB III equipment, including special tools, and additional practice in safety procedures. Each man will swim using the Mark VIII Scuba and the hot water, electrical or isotope heated wet suits

(*Continued on page 16*)

SEALAB III

A Summary of Tasks and Names of Participating Organizations

Oceanography	
Physical	Navy Mine Defense Laboratory
Biology/Ecology	Bureau of Commerical Fisheries
Marine Mammal Use	Naval Missile Center
Geological	Naval Oceanographic Office
Bio-acoustics	Naval Undersea Warfare Center
Biology	Naval Oceanographic Office
Engineering	
Communications; Exposure Suit and Face Mask; and Habitat Engineering	Navy Mine Defense Laboratory
Construction	
Structure	Naval Civil Engineering Laboratory
Salvage	
Bottom Stabilization; Lift Systems; Diver Tools; and Search Procedures	Supervisor of Salvage and Naval Civil Engineering Laboratory
Biological	
Bacteriology	Naval Medical Research Institute
Sleep Studies	Deep Submergence Systems Project
EKG Telemetry	Philadelphia General Hospital
Heated Diver's Dress and Thermal Balance	Naval Medical Research Institute
Human Performance	
Speech and Manual Dexterity	Navy Experimental Diving Unit and Office of Naval Research
Salvage Tasks	Supervisor of Salvage and Office of Naval Research
Construction Tasks	Naval Civil Engineering Laboratory and Office of Naval Research
Visibility Tasks	Navy Mine Defense Laboratory and Office of Naval Research
Crew Observation	Naval Medical Research Institute and Office of Naval Research
Physiologic Test Program	Deep Submergence Systems Project
Atmospheric Control	Naval Research Laboratory
Aquanaut Equipment	Deep Submergence Systems Project
Human Engineering Evaluation	Deep Submergence Systems Project, Office of Naval Engineering, and Submarine Medical Center

Research and Development Objectives for Future Defense Communications System

Colonel John P. Walsh, USAF
Lieutenant Colonel Richard S. Barry, USMC

The Defense Communications System (DCS) is a long haul point-to-point system formed from the assets of the Army, Navy and Air Force. It is operated by the Services under the overall management of the Defense Communications Agency (DCA). The system does not include the tactical communications systems operated by military commanders.

A complex and physically large system, the DCS comprises more than 52,000 circuits, more than 196,000 two-way channels spanning 44 million two-way channel miles. It interconnects 77 different countries and U.S. possessions. A large portion of these facilities are leased from commercial common carriers (see article, "Defense Communications Interface with Commercial Carriers, *"Defense Industry Bulletin*, May 1968, page 10). In FY 1968, leased services cost the DCS $278 million. The investment in military-owned fixed plant is approximately $2.5 billion. Annual operating costs of the whole system ran from about $600 to $700 million in FY 1968. To operate and maintain the system, the Military Services provide more than 40,000 people.

The system includes all types of transmission media, landlines, submarine cables, troposcatter, microwave, high frequency radio, and satellites. The major elements of the DCS include some 118 networks, such as the Strategic Air Command's Primary Alert System, the general purpose Automatic Voice Network (AUTOVON), the general purpose Automatic Digital Network (AUTODIN), the Secure Voice Network (AUTOSEVOCOM), the Defense Special Security Communications System (DSSCS), and certain leased or government-owned transmission media including military communications satellites. At the present time, these networks are in various stages of development, ranging from limited operation to planning.

One fact stands out as being significant from the viewpoint of industry: extensive portions of the system are services leased from commercial carriers. This is particularly so in the United States. Overseas, government-owned facilities are more common. Industry should keep in mind that to the maximum practicable extent, leased services will continue to be a bulwark of the DCS. Later in this article it should become apparent that the DCS will be quite dependent upon industry for future developments, either through government contracts or through the research and development conducted by industry itself.

Planning for the Future

What do defense communicators foresee for the DCS, and what plans are being made?

Planners of the future Defense Communications System formulate future requirements, and then evaluate the present system in detail to identify system deficiencies. Making a broad assessment of projected technology, it is then determined how this technology can be used to satisfy the requirements and enable the DCS to attain its objectives. This results in a Future Concept. To get from the present DCS to that future DCS there is a Transition Plan. This plan describes the manner in which the DCS will progress from one stage to the next as technology and requirements change. Whenever a point is reached where there is a gap in knowledge or in technology, a requirement for research and development is generated.

This, in turn, becomes the subject for a research project, taking advantage of industry's capabilities wherever feasible.

Planning the future DCS can be considered in four areas:

- Long-range requirements, traffic trends, and objectives of the future.
- A broad look at the future DCS, a concept that will satisfy the requirement and objectives while making the maximum use of projected technology.
- Transition from the present system to the future system at a cost we can afford, while getting maximum use of existing plant.
- Research and development that will, hopefully, advance technology, or prove some techniques and, in general, enhance the chances of attaining our goals.

Objectives of the DCS

Some of the objectives of the DCS are national in scope. Some are dictated by purely military needs and constraints. Some are designed to achieve efficiency and economy in the system while satisfying user requirements. These objectives are:

- To achieve a consolidated, high speed, automatically switched system. The work of the immediate past and presently available technology, economic constraints and immediacy of Service demands has not permitted establishment of such a system.
- To achieve a system with a high degree of survivability and reliability. The system must at all times provide at least minimum essential communications in support of critical command and control requirements. There must be world-wide circuits with sufficient alternate routing and redundancy to establish a highly survivable communications system.
- To achieve, by evolution, traffic flow security for the information transmitted over the system.
- To provide a system capable of accepting varied inputs in any digital language without imposing code con-

version constraints on subscribers. The system must also be capable of accepting analog inputs such as speech.

• To achieve more effective communications in face of natural or man-made disturbances on communications media. Communications techniques must permit normal traffic under disturbed conditions.

Projected Trends

Probably the most difficult task is projecting future military communications requirements. Quantitative requirements are very difficult to obtain; qualitative requirements can be forecast more easily.

Long-haul traffic will continue to increase, imposing demands for transmission of speech and data up to 12,000 nautical miles with adequate quality. Digital traffic will increase, and at a very rapid rate until, eventually, it will comprise the major share. As traffic rises, bit rates must increase, imposing a requirement for better terminal, transmission and switching technologies.

DCS planners anticipate a continuing need for real time switching for data as well as voice. Further, there will be a continuing increase in transmission and processing of various types of data on a real time basis for decision making and command and control.

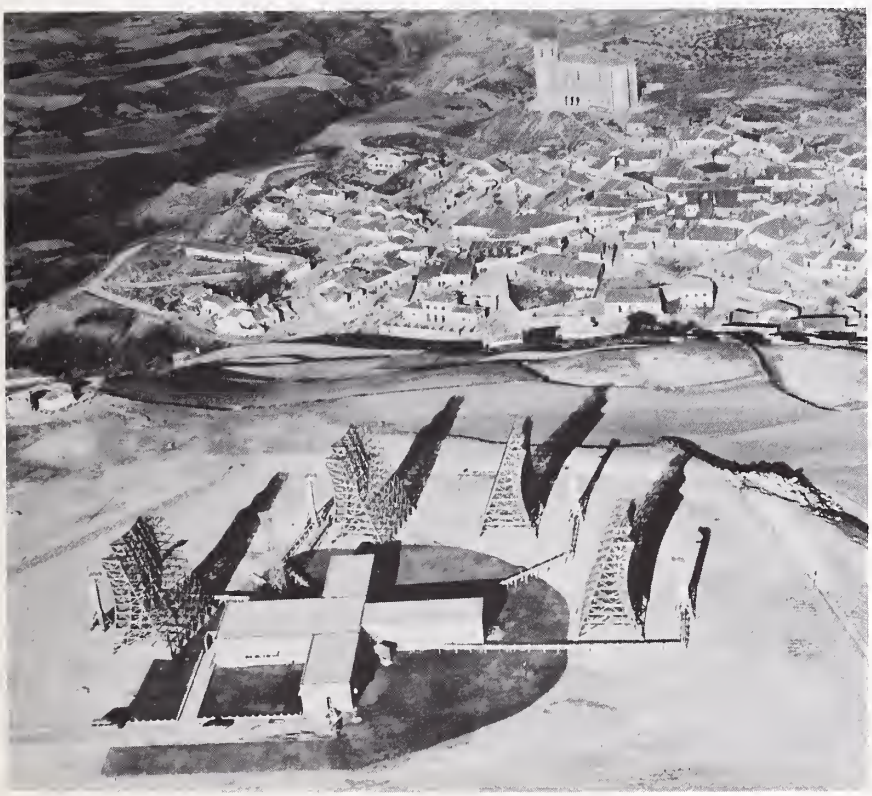
Greater emphasis will be placed on the capability to rapidly expand and extend the system. This includes the ability to extend communications into remote areas, and to expand existing communications in any area. Military experiences of the past few years have proven the urgent need for this capability.

The demand for all types of terminal devices will increase. Mechanical printers, computers, radar sensors, facsimile, video sets, and similar devices probably will be used in the future.

The overall increase in communications, terminal devices and number of subscribers will, of course, have an impact on transmission security.

The increasing variety of terminal devices, coupled with increased demand for secure voice transmission, will probably result in an increased ratio of digital to analog transmissions in the future system.

All of our requirements will be influenced, and in turn will influence, our requirement to use most effectively any new transmission media, particularly satellites.



A centuries old cathedral overlooks the billboard-shaped screens of a Defense Communications System tropospheric-scatter communications antenna at Humosa, Spain. The antennas beam microwaves over the horizon by "bouncing" signals in a carefully plotted ricochet off the troposphere into matching antenna screens at a distant station. This installation is operated by a unit of the Air Force Communications Service.

Character of the Future DCS

The future DCS can probably be best described as an integrated, high speed, global, switched network, configured on a distributed grid basis, digital in nature, employing time division multiplexing, automatic routing and rerouting, automatic status information, and providing a specified grade of service with automatic preemption capability.

Such a system should satisfy everyone's needs.

The future DCS will be global in nature. Except for certain dedicated networks, the system will be hybrid (analog/digital). It will consist of the four general purpose systems mentioned before, which will provide service for secure and non-secure voice and data communications. The trunking for these networks will be derived to the degree possible through circuit switches common to the system. Transmission facilities will be leased from commercial carriers in the United States and Canada, on transoceanic submarine cables, and from certain foreign carriers where quality and reliability permit. Certain intercontinental links will be leased from commercial satellite facilities.

A wide-band, military satellite transmission system will be operational to provide long-haul links for the DCS through appropriately located ground stations.

Alternate routing capabilities through redundant and diverse transmission facilities will be fundamental to the system. In the Continental United States (CONUS) the polygrid AUTOVON routing scheme, envisioned for full implementation by 1970, will have been thoroughly evaluated and improved. By 1980, a more adaptive routing scheme for CONUS should be developed.

Switched system users will use military standard data rates. Long-haul trunk and dedicated-user traffic will be transmitted on media capable of handling bandwidths in megahertz with megabits of information.

For planning purposes, consider-

able attention will be directed toward the far Pacific, eastern Asia and Africa. In Europe a continuous upgrading program is anticipated. In the United States, there may be a realignment of facilities and a continuous program of upgrading, expanding, hardening, and testing of new technologies.

New transmission extensions by the DCS in 1980 will result primarily from satellite transmission sytems. Short links of laser and millimetric wave transmission will be used in the DCS as test links, but these media may not become widespread during this period.

By 1980, the problems associated with selection of routes through commercial networks will have been resolved, and the CONUS portion of DCS will have been arranged into a more survivable grid pattern of better grade circuits with group restoral capability.

Full utilization and control response of the DCS should be possible by means of a monitor and control subsystem. Real time status reporting by switching centers will be displayed at a central facility which, by means of direct control circuits, will redistribute loads and ensure continuity of command and control circuits. Automatic reporting, with manual control, should be operating on a world-wide basis by 1980. From experience with this system should come the necessary statistical data for a future computer controlled system.

The DCS will remain bandwidth limited on radio circuitry operating below 10 GHz for the foreseeable future. Consequently there is urgent need for techniques for processing more information per cycle of available bandwidth.

The system overall must be capable of reasonable maintenance and logistic support. Its components cannot be so unique or complex of design as to require the training and maintenance of an excessive number of special skills, nor to require excessive spare parts stock.

This, then, is the concept. The next question is: Can we get from the DCS of today to the conceptual system of tomorrow and, if so, how?

The concept must be expanded and evaluated to indicate its demands in terms of technologies, hardware, interface, quantity and quality. The concept must be defined in engineering terms. In general, it is the philosophy at the Defense Communications Agency to evaluate the feasibility of any such generalized concept as "all digital" or "effectively integrated" by rigorous engineering analysis.

Once the feasibility of a concept has been demonstrated, an attempt is made to ascertain the optimum course of action by appropriate engineering cost effectiveness studies.

At the present time, it is recognized that definitive plans for an effectively integrated, world-wide hybrid system cannot be developed until after the completion of two significant studies:

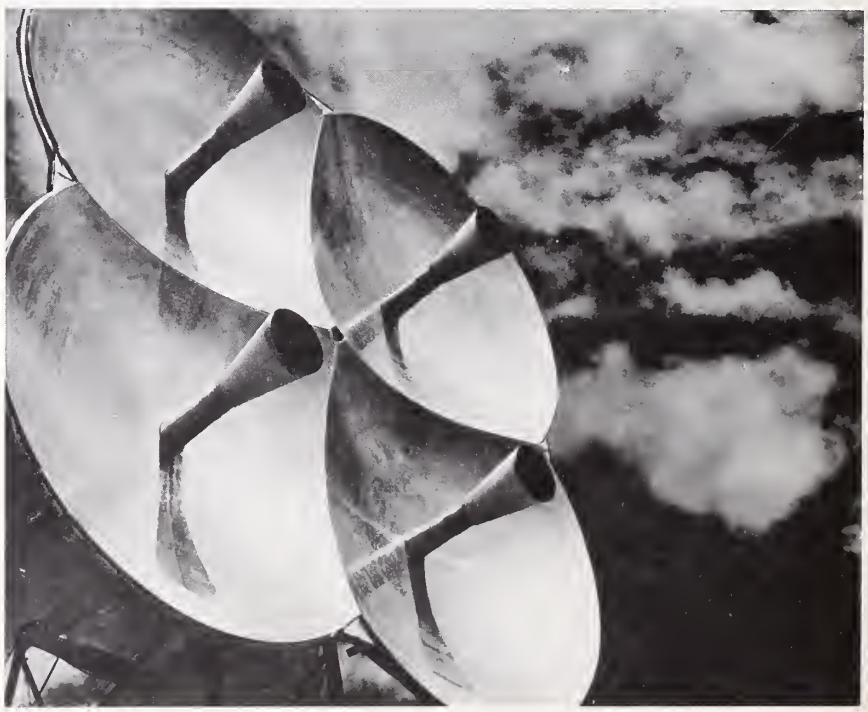
- Should we developed a new all-digital universal switch? Or should the existing AUTOVON switches be modified to perform digital circuit switch functions?
- What should be the engineering objectives and standards for digital transmission up to 12,000 nautical miles, including the how, where and when time division multiplexing can best be used in the DCS?

Both of these studies are necessary to the logical evolution of the DCS from its present configuration to a future hybrid system emphasizing digital techniques. These studies will provide cost analysis and engineering evaluation necessary to substantiate the future concept. Additionally, they will furnish technical and economic tradeoffs of possible alternative methods of attaining our goals for the future DCS.

One other prime consideration at this time is the extent of integration of the individual switched networks. Both near-term and far-term aspects must be considered.

For the near term, integration of the existing DCS subsystems (AUTOVON, AUTODIN, AUTOSEVOCM, etc.) is considered essentail to provide DOD with communications facilities which will meet the military requirements of reliability, survivability and efficiency of operations.

For the far term, with the goal of an efficiently integrated world-wide system capable of handling a vast volume of digital traffic, the subject of how much integration is under continued examination.



Cloverleaf shaped antenna of air transportable AN/TSC–54 satellite terminal stands out against sky. The quick-reaction terminal and its six-man crew can be loaded aboard a C–130 transport. At its destination, the crew can assemble the terminal within two hours and be ready for both teletype and voice communication via satellite. These terminals are on duty in several overseas locations.

Research and Development for the Future DCS

Many innovations will be necessary, most of which appear technically feasible, but they are not now available off-the-shelf. This brings us to the final important portion of this article—research and development.

A great deal of research and development work will be needed before we will realize the system described here. Planners at DCA feel that the rapidly advancing communications technology will provide the needed hardware. Even today, industry is developing some of the needed equipment.

Several research and development tasks for the next few years have been identified and merit more detailed discussion.

Recognizing that the trend in transmission will be away from relatively narrowband, high signal-to-noise channels toward wideband, relatively low signal-to-noise channels, with digital regeneration, much effort is being devoted to the need to accommodate the rapidly increasing quantity of digital traffic expected in the future. Areas of DCS-sponsored research relative to this effort are:

- Wideband data tests.
- Digitized voice or analog/digital converters.
- Time division multiplexing.
- Millimeter waves.

In addition, recognizing that technical control is the single most vital part of the communication system and the key to efficient operation, increased emphasis needs to be devoted to development of automatic technical control facilities. These control facilities must be standardized enough to allow simple operation, maintenance and logistic support.

Parallel to these efforts, there is increasing interest in the need for development of transportable communications complexes. These should be designed to provide timely and adequate communications in a variety of contingency situations, and flexibility in planning and installing easily expanded or extended communications sites.

Wide Band Channels Needed

In the past, the basic design criteria for all tranmission media have been the 4 KHz channels with telephone inputs in analog form. Data had been handled as an extra requirement and transmitted through normal telephone procedures. Some progress has been achieved in conditioning circuitry for data transmission. However, the transmission media of the 1970–1980 time frame will be required to carry high-speed data, at extremely low error rates of one part in 100,000 or better, over 12,000 nautical miles. This will require further development of digital transmission techniques and evaluation of the capabilities of future wideband transmission to meet these stringent requirements. DCA has investigated the transmission media to meet our future requirements. The basic conclusion has been that detailed fine grain data on 48 KHz and wider channels are not completely available.

One task is to determine the channel characteristics of 48 KHz and wider channels in a sufficiently fine grain structure to determine the optimum transmission bit rate as a function of error rate. After determining the fine grain transmission media structure, specifications are to be prepared for modems and associated transmission equipment.

The minimum requirements are:

- Determine the current capabilities, based on all available knowledge, of these wideband media to transmit composite data in the 48 KHz or wider channels.
- Determine and define unknown parameters and devise a test program to obtain the required field test data. Obtain the necessary instrumentation, run the required field tests, and evaluate the data.
- Prepare definitive specifications, based upon that test program, for the hardware required by the DCS to obtain the transmission quality that will be needed to meet future user requirements.

Testing on the tropospheric scatter medium has recently been completed and analysis is in progress.

Presently, a similar testing effort is starting on landlines, microwave, satellites and submarine cable.

Analog-Digital-Analog Conversion

With few exceptions, information transmitted on communications channels today is in analog form. Digital data must be converted to analog for tranmission, and then be reconverted to digital at its ultimate destination. By transmitting data in a digital mode, the digital-to-analog (D/A) and analog-to-digital (A/D) conversions will be eliminated. Transmitting in a digital mode will also enhance bulk encryption.

Analog signals will, of course, require conversion for entry into the digital transmission system. Development of converters is another part of the research and development effort.

An important feature of a digital system is the capability of reconstructing the signal at any terminal or relay point along its path. Regeneration not only reconstitutes the signal, but removes accumulated distortion and retimes the signal, thereby permitting substantially greater transmission distances. Regenerators in common use today are designed primarily for teletypewriter circuits, and do not operate at the high bit rates required in the future DCS. Development of general purpose regenerators will permit transmission over substantially greater distances with an acceptable error rate, and will allow the use of less expensive transmission media.

The DCS needs a family of regenerators which can be operated throughout the system at DCA standards prescribed rates. Microelectronic techniques should be used to minimize size and weight, and to reduce power and air conditioning requirements.

A large body of technology has been evolving based on modems, modulation, coding, etc. Effort is now required to develop the optimum combination of these various techniques to provide a standard information language that will permit full-time communication under adverse conditions, while using DCA standards tranmisssion rates. Possibly the outgrowth of this task will be equipment for signal processing, plus storage buffering to obtain maximum information exchange at acceptable performance levels. Studies and tests to determine the characteristics of 48 KHz and wider channels will contribute to this task.

Since most of the data in its original form will be digital in nature, the digitalization of voice is of prime importance, to allow standardization of traffic throughout the DCS transmission network. The necessity for digitalizing voice for security encryption, in itself, warrants further development. The simplification of handling digitalized voice through the

switched network gives even further impetus for developing A/D/A converters.

Analog/digital conversion devices in common use today are all directed toward specific purposes, and require high bit rates to retain the analog quality desired at the receiving end. The need is for general purpose conversion devices to translate voice and graphic signals. Emphasis should be placed on minimizing digital bit rate, reducing size to allow equipment to fit into terminal instruments, and reducing production costs.

Tasks that have been identified are:

- Investigate analog digitalization techniques to determine if high quality analog signals can be transmitted at bit rates of 2,400, 4,800 and 9,600.
- Investigate speech compression/digitalization techniques to determine if it is technically feasible to reduce the size of speech compression and digitalization devices to fit into telephone subsets, while maintaining or improving the quality and intelligibility now obtained with vocoders.
- Based on these investigations, develop a family of standardized converters for voice and facsimile which will be compatible with the future digital DCS. The goal is increased reliability, better performance, and reduced cost.

Time Division Multiplexing

The next major transition in DCS will be to a hybrid analog/digital system. A hybrid time-division-multiplex/frequency-division-multiplex system will be needed to economically handle intermixed digital and analog traffic, while retaining the balance of existing frequency division multiplex equipment of the DCS.

Techniques for time-division multiplexing (TDM) 75 x 2^n rate data channels into frequency-division group and supergroup communication channels require study and development. To be investigated under this task are:

- Development of TDM equipment capable of handling data channels with speeds from 75 bits per second up to 1.228 Mbs and, if future needs dictate, higher rates. While DCA is concentrating on 75 x 2^n rates, industry is investigating some other rates. DCA planners watching these disparities will periodically review DCS needs and investigate other modulation rates to insure full utilization of the bandwidth available.
- Development of techniques to provide 50 microsecond channel envelope delay. This effort will increase the data capabilities of frequency division multiplexing (FDM) equipment as well as permit more orderly and more economical development of TDM systems.

A feasibility model of a TDM multiplexer is scheduled for delivery shortly. A study to determine how this device will fit into the evolutionary conversion of the DCS from analog to digital transmission is in progress and will be completed shortly.

Millimetric Relay Systems

With the advent of very wideband terminal devices, there will develop requirements to net various numbers of these devices in highly concentrated areas. New techniques and equipment to use millimeter wave bands offer great inducement to investigate this area. Possible longer distance transmission can be achieved by using the relatively shorter millimetric wave paths in the same manner that conventional microwave relay systems are used today.

DCA presently has underway in the Washington area a test program to determine the technical and operational feasibility of millimetric wave propagation. Results to date have been promising. With the completion of this work, a Military Department will assume responsibility for further study and testing. It is intended that this effort will conclude in a recommendation for a proposed system and for follow-on development and evaluation of a prototype.

An operational millimetric system will provide the DCS with even greater bandwidth than conventional microwave systems and will make possible simultaneous transmission of many secure television, wideband facsimile and voice channels.

The effort so far described will have application to satellite links also. There are several study efforts comparing coherent versus noncoherent modulation schemes for satellite transmission. These studies also consider the peculiar requirements of mobile and fixed terminals.

Technical Control Needs Modernization

The DCS must remain operational under conditions of stress caused by either natural or man-made phenomena. Thus it must be adaptable to automatic routing and control. The present DCS is primarily manual. Because of the scope of the data needed to maintain the status of the net, it will be beyond the capability of the human by himself. Modernization of the technical control facility has not kept pace with changes in the size of the system and the basic hardware entering the system.

Reliability and efficiency of the DCS must be improved by continually monitoring all circuits, on a noninterference basis, and automatically switching traffic from deteriorating to adequate circuits as required to assure maximum information transfer. Presently, there is planning in progress to update existing facilities with more modern and partially automatic equipment. Simultaneously, a research and development program is underway on a system using the maximum profitable amount of automation.

The initial study effort will determine the degree of automation feasible for adaptation by technical control facilities. The study will use a

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typical operating facility to determine optimum parameters for assessing equipment/channel performance, and the availability or need to develop sensing devices for measuring the parameters. Functions of such equipments as data processors, displays, peripheral devices, automatic patching equipment, monitor consoles, line conditioning equipment, etc., will be established. The availability of such equipment, or the need to develop it, will also be determined. Then research and development will be started on a model technical control system employing all the automatic features which have been determined desirable and feasible. The model will be installed in an operational technical control facility to determine its suitability as the standard system for the DCS.

Transportable Communications Packages Needed

There is great need in the DCS for transportable communications complexes. They can be classified into two types: lightweight compact facilities and heavy facilities. The borderline between the two is somewhat vague but is essentially determined by traffic handling capacity and the duration of use. The heavy system should be capable of indefinite operation as a permanently fixed installation.

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Contingency systems composed of existing inventory are already under development. The need is for a lighter weight station with all the capabilities of those stations presently being assembled. A desirable addition is a small digital message switching capability.

Presently, a cost and worth study is underway to determine where the most practical size reduction can be achieved. This will be followed by a Technical Development Plan. Finally, hardware development will be identified.

There is a simultaneous interest in developing a family of standard heavy transportable communications equipments of various sizes and capabilities which can be used to configure or reconfigure fixed communication stations and transmission systems. This will provide commonality and compatibility.

The technical concept of a family of heavy transportables is based on the recognition that the long-haul fixed system of the DCS encompasses a broad range of transmission, technical control and switching requirements. This broad range dictates that the family of heavy transportable equipment must be composed of building blocks, which can be assembled to provide facilities appropriate to the particular global operation or environment. Each block should be a functional communications module which could be used for replacement, restoral, or capacity increase, or used with other modules to establish partial or complete facilities or stations.

The shelters to house this modular equipment should be sufficiently flexible to allow expansion or reconfiguration as any specific communications mission may require. In addition to satisfying the broad range of communications requirements, the heavy transportable equipment must preserve the human engineering factors associated with the fixed station environment.

The family of transportables, in ultimate configuration, would have every capability that the DCS now possesses.

It appears that the techniques and components capable of doing the job are already existent. The development of heavy transportable equipment for near-term applications is predominently a packaging job, or engineering development. A Technical Development Plan is just now getting underway for delivery next year. The plan will define equipments and configurations for the ultimate system.

With the availability of the Technical Development Plan, development, test evaluation, and service testing will follow in that order, resulting in a family of modules capable of fulfilling many missions in many configurations.

Future DCS research and development can be summarized into five areas:

- Advanced multiplexing techniques.
- Transmission media.
- Regenerative repeaters.
- Switching equipment.
- Modular equipment packages.

The objective is a system that is expandable on a world-wide scale, highly survivable and standardized to the greatest possible extent. Some of this research and development will be done within the Government, and some through contracts; however, the future of the DCS will also be dependent upon the research and development conducted by industry itself.

New Functions Given to ARADCOM Field Office at Redstone

The Army Air Defense Command has expanded its liaison office at Redstone Arsenal, Ala., and changed its designation to that of field office.

Expansion of the office came as a result of the establishment of the Sentinel Ballistic Missile Defense System Command Headquarters at Redstone Arsenal.

A major function of the new office will be the continued coordination between the Army Air Defense Command and the Army Missile Command at Redstone, concerning anti-aircraft missile systems now operational or in development.

The field office will also serve as a point of contact between the Army Air Defense Command and other organizations located at Redstone.

Colonel James W. Young, former Air Defense Command Liaison Officer, heads the new field office.

Value Engineering

(*Continued from page 4*)

( ) Do you conduct formal value engineering workshops to expand your in-house capabilities?

Few, if any, of the major corporations in the defense industry today can affirmatively answer all of these questions, but the more successful contractors can generally answer many more of these questions in a positive fashion than can those companies with lesser performance records.

Honeywell Ordnance experience is an excellent example of the mutual benefits that industry and DOD can obtain from value engineering incentive provisions. Its experience and the experience of several other leading companies have demonstrated that VECPs offer a sizeable potential for augmenting defense industry income if top management will take the actions necessary to realize the potential, and organize and commit proper resources to a sustained VECP effort.

Defense industry management is increasingly "sitting down" with key DOD personnel to review the mutual advantages of VECPs, and to agree on "local ground rules" for volume submission of VECPs. With proper support from both industry and DOD, value engineering contract incentives may well become a major entrepreneurial innovation of our current times.

VSX Definition Contractors Selected

The Naval Air Systems Command has selected two contractors to perform contract definition effort for the VSX (Developmental Antisubmarine) weapon system.

Contracts totaling $19 million will go to Convair Division of General Dynamics Corp., San Diego, Calif., and Lockheed-California Corp., Burbank, Calif., teamed with Ling-Temco-Vought Aerospace Corp., Dallas, Tex.

The VSX is envisioned as a carrier-based antisubmarine warfare aircraft to replace the S–2 Tracker, a twin reciprocating engine plane.

Computers for the VSX will be capable of analyzing underwater sounds and other required sources of information and presenting the data on television-type displays for interpretation.

Man in the Sea

(*Continued from page 9*)

which will be used in the experiment.

As D-Day—meaning "down day"—approached, the 40 aquanauts were selected and divided into five teams. Groups of aquanauts began traveling to the San Francisco Bay Naval Shipyard about six months before the experiment was scheduled to begin to take part in systems integration tests. These tests, about six weeks in duration, made certain that all parts of the equipment—the support ship, diving system and habitat—fit together. Each aquanaut is responsible for knowing his own equipment, such as Mark VIII Scuba, wet suit, and equipment related to his own bottom work. He must also know the multitude of gauges, valves, levers, plugs, outlets, switches and indicators installed in the habitat and, to a lesser extent, in the diving systems.

Two weeks before the experiment begins, the surface support ship and habitat will be moved to the Long Beach Naval Shipyard for shallow water tests. There the habitat will be lowered to a depth of about 45 feet and the entire SEALAB III complex will be connected for integration tests. At Long Beach, the aquanauts will receive on-the-job training. Throughout this period of equipment tests, the aquanauts themselves will continually undergo examinations at nearby naval hospitals and at DSSPTO.

A few days before the experiment begins, the surface ship, habitat, support craft and aquanauts will move to the test site off San Clemente Island, where the habitat will be lowered to the bottom.

Aquanauts will assist the support ship personnel and support divers in handling the habitat and in rigging the life support and communications umbilicals between the support ship and the sea floor habitat, and between the habitat and San Clemente Island. These last minute activities will give the aquanauts a final look at the status of the various components of the SEALAB III complex. Then, two of the aquanauts of the first eight-man team will descend to the ocean floor and will enter the habitat. After a final check of the habitat's equipment, they will declare the habitat ready for their fellow team members.

Training ends there. SEALAB III—man's most ambitious effort to explore and exploit the ocean depths by living on the ocean floor—will be underway.

AIAA Annual Meeting Set for Oct. 21–24 in Philadelphia

The military's traditional role as the cutting edge for new technology will be demonstrated during the annual meeting of the American Institute of Aeronautics and Astronautics (AIAA).

The meeting and its associated technical display of aerospace hardware, concepts and capabilities will be held Oct. 21–24 at the Civic Center in Philadelphia, Pa.

Brigadier General R. A. Gilbert, Director of Laboratories for the Air Force Systems Command, will act as chairman of the opening session, which is entitled, "Aerospace Technology—the DOD Point of View."

Others presenting papers during the first session will be Brigadier General Charles D. Y. Ostrom Jr., Director of Army Research, Office of the Chief of Research and Development; Rear Admiral Thomas B. Owen, Chief of Naval Research; and Brigadier General Leo A. Kiley, Commander of the Office of Aerospace Research.

Technical thrust of the meeting will focus on four multi-discipline themes plus a related technical specialist program. The themes are: "Expanding Air Transportation," "Renaissance in Aircraft Design," "The Space Program—Today and Tomorrow," and "Special Issues."

Special tours for scientists and engineers who work in the Pentagon and at other military and government installations in the Washington, D.C., area, are being arranged by the AIAA.

Information concerning tours can be obtained by calling Raymond E. Forbes of the General Electric Co., Washington, D.C., Phone (202) EX 3–3600. Additional information on the meeting may be obtained from the Public Affairs Department, American Institute of Aeronautics and Astronautics, 1290 Avenue of the Americas, New York, N.Y. 10019.

MEETINGS AND SYMPOSIA

OCTOBER

Matrix Methods in Structural Mechanics Conference, Oct. 15–17, at Wright-Patterson AFB, Ohio. Co-sponsors: Air Force Flight Dynamics Laboratory and the Air Force Institute of Technology. Contact: Mr. Berke (FDTR), Air Force Flight Dynamics Laboratory, Wright-Patterson AFB, Ohio 45433, Phone (513) 257–1110, Ext. 55651.

Second International Meeting on **Silicon Carbide**, Oct. 21–23, at Pennsylvania State University, University Park, Pa. Sponsors: Air Force Cambridge Research Laboratories, Pennsylvania State University and the Carborundum Co. Contact: C. E. Ryan, Air Force Cambridge Research Laboratories (CRWF), L. G. Hanscom Field, Mass. 01730, Phone (617) 274–6100, Ext. 2234.

Explosive Chemical Reactions Seminar, Oct. 21–23, at Durham, N.C. Sponsors: Army Research Office, Air Force Systems Command and the Naval Ordnance Laboratory. Contact: James Norman, Dir., Research and Technology Div., Army Research Office, Box CM, Duke Station, Durham, N.C. 27706, Phone (919) 286–2285, Ext. 22 or 44.

Successful Application of Value Engineering, Annual Meeting of the Value Engineering Div., American Ordnance Association, Oct. 23–24, at Andrews AFB, Md. Contact: Col. John Dickson, American Ordnance Association, Transportation Building, 17th and H Streets, N.W., Washington, D.C. 20006, Phone (202) 347–7250.

International Electron Devices Meeting, Oct. 23–25, at the Sheraton-Park Hotel, Washington, D.C. Sponsor: Institute of Electrical and Electronics Engineers Electron Devices Group. Contact: Dr. B. J. McMurtry, Sylvania Electronic Systems, P.O. Box 188, Mountain View, Calif. 94040, Phone (415) 966-2855.

Engineering Aspects of Solidification Meeting, Oct. 28–30, at Boston, Mass. Sponsors: Army Materials and Mechanics Research Center, American Society for Metals and American Foundrymen's Society. Contact: Dr. Paul J. Ahearn, Army Materials and Mechanics Research Center, Watertown, Mass. 02172.

NOVEMBER

International Symposium on **Equatorial Aeronomy**, Nov. 2–10, at Ahmedabad, India. Sponsors: Office of Aerospace Research, Voice of America, Cambridge Research Laboratories, and Environmental Science Services Administration. Contact: Edwin J. Chernosky, Air Force Cambridge Research Laboratories, L. G. Hanscom Field, Mass. 01730, Phone (617) 274–6100, Ext. 3714.

Science, Philosophy and Religion—Weapons Technology Conference, Nov. 13–15, at Kirtland AFB, N.M. Sponsor: Weapons Laboratory, Air Force Special Weapons Center. Contact: Lt. Col. Rizzo, Air Force Weapons Laboratory (WLRP), Kirtland AFB, N.M. 87117, Phone (505) 247-1711, Ext. 2320.

DECEMBER

Reliability Physics Symposium, Dec. 2–4, at Washington, D.C. Co-sponsors: Institute of Electrical and Electronics Engineers and Rome Air Development Center. Contact: J. Vaccaro (EMERP), Rome Air Development Center, Griffiss AFB, N.Y. 13440, Phone (315) 330–2813.

International Wire and Cable Symposium, Dec. 4–6, at the Shelburne Hotel, Atlantic City, N.J. Sponsor: Army Electronics Command. Contact: Milton Tenzer, Electronic Parts and Materials Div., Electronic Components Laboratory, Army Electronics Command, Fort Monmouth, N.J. 07703, Phone (609) 535–1834.

JANUARY

Titanium Coordination Meeting, (date undetermined), at Wright-Patterson AFB, Ohio. Sponsor: Air Force Materials Laboratory. Contact: Dr. H. L. Gegel, Air Force Materials Laboratory (MAMS), Wright-Patterson AFB, Ohio 45433, Phone (513) 255–2624.

Fundamental Interactions at High Energy Meeting, Jan. 22–24, at the University of Miami, Coral Gables, Fla. Sponsor: Office of Scientific Research. Contact: Capt. D. R. Lehman, Air Force Office of Scientific Research (SRPN), 1400 Wilson Blvd., Arlington, Va. 22209, Phone (202) Oxford 4–5581.

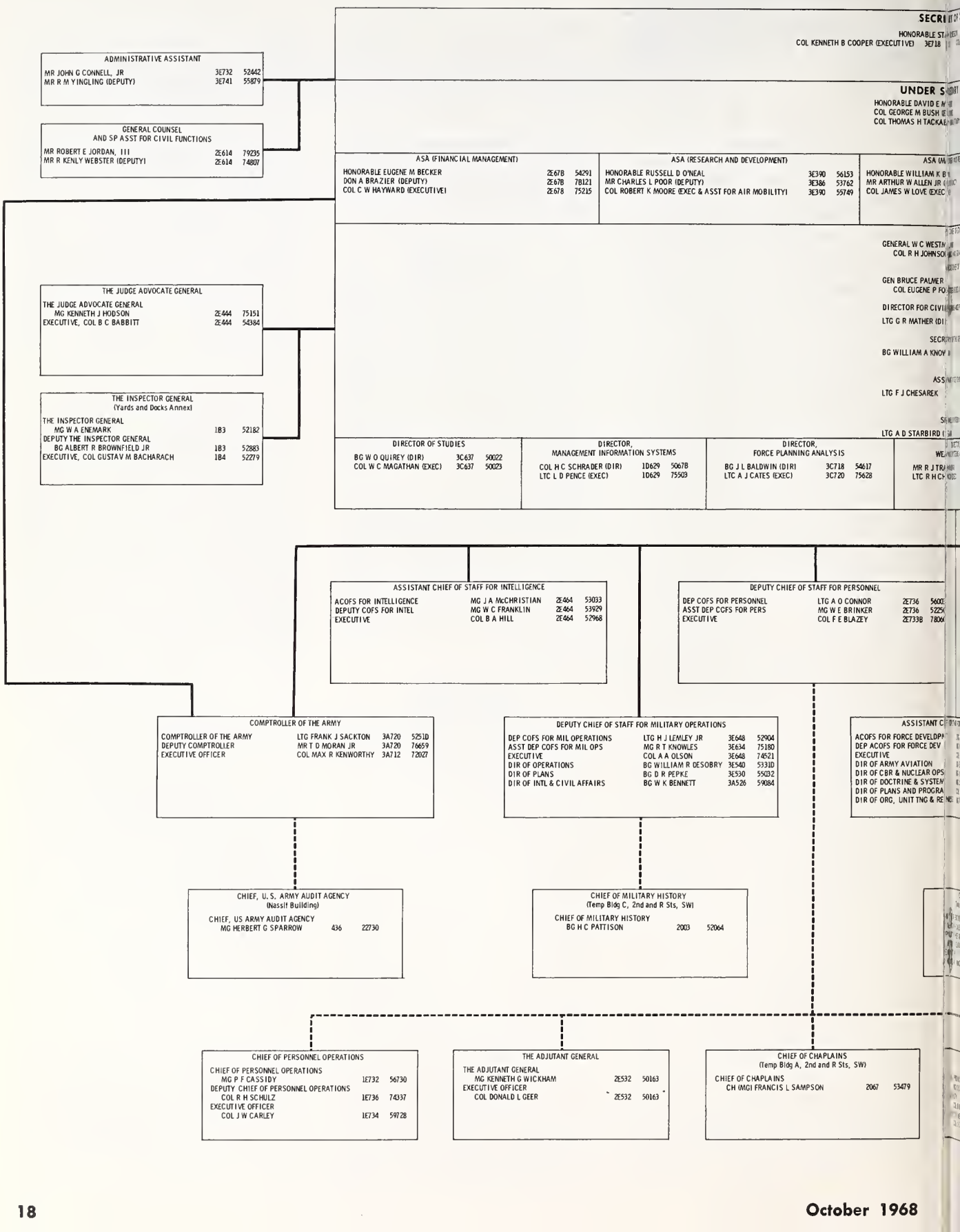
Telemetry Meet Set IEEE Calls for Papers

Authors have two and one-half months remaining to write and submit papers for the 1969 National Telemetering Conference. The Institute of Electrical and Electronics Engineers has issued a call for papers to be presented at the April 22–24, 1969, conference in the Washington Hilton Hotel, Washington, D.C. The theme is Telemetry in the 70s.

Papers are invited on five areas: aerospace, oceanographic, biomedical, and industrial/environmental telemetry, and communication technology. Papers should be limited to 4,000 words and six illustrations, and should be submitted in two complete copies, with three copies of an abstract not exceeding 100 words. Submissions must reach the Technical Program Chairman before December 20, 1968. He is Dr. Robert W. Rochelle, NASA-Goddard Space Flight Center, Code 710, Greenbelt, Md. 20771, Telephone (301) 982–4615.

Authors will be notified of acceptance by Feb. 3, 1969, and will be provided with a guide and paper preparation kit for the final manuscript.

Exhibits of the latest telemetry hardware, instruments and components are planned for the meeting. Further information is available from Ralph Whitener, National Telemetering Exposition, 1040 Shoreham Building, Washington, D.C. 20005, Telephone (202) 347–0425.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DIR OF PLANS AND PROGRA
DIR OF ORG, UNIT TNG & RE
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CHIEF, US ARMY AUDIT AGENCY
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THE ADJUTANT GENERAL
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EXECUTIVE OFFICER
COL DONALD L GEER 2E532 50163
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RY OF THE ARMY
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2E722 76806
TARY ASSISTANT) 3E718 52947

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TI) 2E954 55291
2E591 71967

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MR HUBERT A SCHON (DEPUTY DIRECTOR FOR OPERATIONS) 3E336 59384
MR ROBERT E YOUNG (EXEC ASST) 3E346 53374

F STAFF
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SR AIDE) 3E668 52110
F OF STAFF
3E668 54371
EC) (ASST SGS) 3E668 54372
NCE PLANNING AND OPERATIONS
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E GENERAL STAFF
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CHIEF OF STAFF
3D656 50294
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MG J R DEANE JR	3E480	75116
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BG T J CAMP	3E452	73725

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DEP CHIEF OF RSCH & DEV	MG R E COFFIN	3E412	7B187
CHIEF SCIENTIST, OA	OR M E LASSER	3E424	72612
EXECUTIVE	COL S C MEYER	3E412	54997
DIR/PLANS & PROGRAMS	BG T T PAUL JR	3E436	56768
DIR/DEVELOPMENTS	BG T W MELLEN	3E374	75083
DIR/ARMY RESEARCH	BG C O Y OSTROM JR	3E374	73710
DIR/MISSILES AND SPACE	COL T N CHAVIS	3E360	72449

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CHIEF, OFC OF RES COMPONENTS	LTG F C WEYLAND	2E524	52786
DEPUTY CHIEF	MG J M HIGHTOWER	2E524	56229
EXECUTIVE	COL C E BALTHIS JR	2E524	59488

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CLARKE 1223 55363
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ROVOST MARSHAL GENERAL
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Y
L W A WALSWORTH 1068 62857
TIVE
L J C SHOULTZ JR 1070 62824

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(Main Navy Building)
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LTG L O HEATON, MC 2054 63335
DEPUTY SURGEON GENERAL
MG G J COLLINS, MC 2056 64112
EXECUTIVE OFFICER
COL ROBERT P CAMPBELL, MC 2056 63122

ABOUT PEOPLE

DEPARTMENT OF DEFENSE

Brig. Gen. Leo E. Benade, USA, has been appointed Dep. Asst. Secretary of Defense (Military Personnel Policy) in the Office of the Asst. Secretary of Defense (Manpower and Reserve Affairs).

Col. John H. Burke, USA, has been named Inspector General of the Military Traffic Management and Terminal Service (MTMTS).

In another change at MTMTS headquarters, **Col. William E. Burton, USA,** replaced **Col. Henry G. Dettmar, USA,** as Dir. of Passenger Traffic.

Capt. Robert R. Campbell, USN, is the new Commander, Defense Contract Administration Services Region, Boston, Mass.

Robert C. Moot was sworn in as Asst. Secretary of Defense (Comptroller) on Aug. 1. He succeeds **Robert N. Anthony** who resigned to return to the faculty of Harvard Business School.

Mr. Moot has been Administrator of the Small Business Administration since Aug. 1967, serving first as Dep. Administrator beginning in Dec. 1966. From 1962 to 1965 he was the first Comptroller of the Defense Supply Agency. In June 1965, Mr. Moot was appointed Dep. Asst. Secretary of Defense for Logistics Services, a position he held until he moved to the Small Business Administration. He has been in Federal service since 1946.

Capt. Edgar C. Chapman Jr., USN, has assumed duties as Chairman, Armed Service Procurement Regulation Committee in the Office of the Asst. Secretary of Defense (Installations and Logistics).

Capt. Murry Cohn, USN, has reported to the Defense Contract Administration Services Headquarters, Alexandria, Va., for duty as Chief of the Production Management Div.

Col. Raymond B. Furlong, USAF, has been named Mil. Asst. to Dep. Secretary of Defense.

Capt. Harold W. Simpson, USN, has been assigned as Commander, Van Nuys Dist., Defense Contract Administration Services Region, Los Angeles, Calif.

DEPARTMENT OF THE ARMY

Brig. Gen. Wallace L. Clement has been named Chief of Staff, Army Combat Developments Command (CDC), Fort Belvoir, Va. **Col. Charles B. Hazeltine Jr.,** was assigned as Dep. Chief of Staff. The assignments resulted from realignment of the CDC's command structure.

Col. Robert H. Clagett Jr., has assumed the position of Dep. Commander, Army Strategic Communications Command—CONUS. He replaces **Col. Joseph T. Adinaro.**

Col. John R. Oswalt Jr., has succeeded **Col. Edward G. Anderson Jr.,** as Commanding Officer, Army Engineer Topographic Laboratories, Fort Belvoir, Va.

Col. Arthur H. Sweeney Jr., has been appointed as the new Dep. Commanding General, Army Weapons Command, Rock Island, Ill.

Col. George W. Casey, Dep. Dir. of Doctrine, Army Combat Developments Command, Fort Belvoir, Va., has been nominated for promotion to brigadier general.

DEPARTMENT OF THE NAVY

VAdm. David C. Richardson, now serving as Asst. Dep. Chief of Naval Operations (Air), has been selected as Commander of the U.S. Sixth Fleet.

RAdm. Jack J. Appleby has taken command of the Naval Supply Center, Oakland, Calif.

RAdm. Charles A. Blick, head of the Navy Resale System and Commanding Officer, Navy Ship's Store Office, (NSSO) Brooklyn, N.Y., has retired from active duty after more than 35 years service. **Capt. John E. Morrissey,** NSSO Executive Officer, will act as temporary commander.

RAdm. Donald G. Irvine is the new Commandant of the Naval District, Washington, D.C.

RAdm. Robert A. MacPherson has been assigned as Commandant of the Eighth Naval District.

Capt. James D. Mooney has taken over as Dep. Vice Commander, Pacific Missile Range, Point Mugu, Calif.

Capt. Edward C. Oldfield Jr., has relieved **Capt. Grover V. Clark** as Commanding Officer, Naval Supply Center, Newport, R.I.

The Bureau of Naval Personnel has also announced the following assignments: **Capt. William D. Baker,** Commanding Officer, Naval Ammunition Depot, Hawthorne, Nev.; **Capt. Greer A. Busbee Jr.,** Commanding Officer, Chesapeake Div., Naval Facilities Engineering Command, Washington, D.C.; **Capt. Hollis W. Cooley,** Officer-in-Charge, Cheatham Annex, Naval Supply Center, Norfolk, Va.; **Capt. Henry E. Davies Jr.,** Commanding Officer, Naval Ammunition Depot, Oahu, Pearl Harbor, Hawaii; **Capt. John C. Donahue,** Commanding Officer, Naval Ammunition Depot, Crane, Ind.; **Capt. John H. Garrett Jr.,** Commanding Officer, Navy Electronics Supply Office, Great Lakes, Ill.; and **Capt. Charles J. Merdinger,** Commanding Officer, Western Div.; Naval Facilities Engineering Command, San Bruno, Calif.

DEPARTMENT OF THE AIR FORCE

The following personnel have been assigned to the Air Force Systems Command (AFSC), Air Force Logistics Command (AFLC), and the Office of Aerospace Research (OAR):

(Continued on page 30)

DOD Lists Factors Indicating Contractor Compliance with Equal Opportunity Requirements

The Defense Department has released a list of factors, conditions and practices which indicate the degree of compliance by Federal contractors with the equal employment opportunity requirements of Executive Order 11246.

Factors cited include such items as recruiting practices designed to attract minority groups, interviewing techniques which avoid bias, non-discriminatory test criteria and training programs, equality in facilities, and fair appraisal procedures.

The factors are for use by officials of the Contracts Compliance Office, part of the Defense Supply Agency's Defense Contract Administration Services, in conducting compliance reviews required under the rules which implement the Executive Order (Chapter 60, Title 41, Code of Federal Regulations).

Purpose of the compliance reviews is to determine if prime contractors and subcontractors maintain nondiscriminatory hiring and employment practices.

The listing of factors is intended to assist the reviewer in his task of bringing into focus those aspects of a contractor's program that must be considered if a reliable judgment is to be made regarding the contractor's compliance.

However, the factors listed do not represent all actions and practices which a contractor might undertake in support of the equal employment program. Conversely, the absence of any of these factors does not necessarily establish a condition of noncompliance. Each finding that results from the application of the items in the listing to an actual plant situation must be related to other findings. The total findings then must be related to actual results in terms of the employment of minority applicants and the non-bias treatment of employees. It is the results which will determine whether the contractor is complying with the Executive Order.

Offices of Contracts Compliance are established in the 11 regional offices of the Defense Contract Administration Services across the country. The offices are responsible for elimination of discrimination by Federal contractors.

The following factors indicate compliance.

Contractors' Policy Implementation

- Company policy exists in writing in precise terms.
- Policy is reflected in external dealings with labor unions, recruitment sources and subcontractors (including use of equal employment opportunity clause in purchase orders).
- Policy is reflected in internal dealings through employee booklets, bulletin boards, house publications, supervisors' training, employee representatives, and the posting of equal employment opportunity notices.
- Certification is received, prior to the award of any non-exempt subcontract, of non-segregation of facilities [41 Code of Federal Regulations 60–1.8 (b)].
- Responsibility for equal employment opportunity is defined for each level of management.

Personnel Recruitment

- The "Equal Opportunity Employer" line is included in recruitment advertising.
- Minority group sources are contacted to stimulate applications and consistent liaison is maintained with these sources.
- Job opportunity information is made equally available to minority group and non-minority group applicants.
- Recruitment offices are easily found, well-marked, and accessible to applicants.
- Employment qualification requirements are not inflated.
- Application and filing procedures are not so complicated as to discourage minority group applications.
- Records are maintained as to applications received and the disposition made of them.

Personnel Interviewing and Processing

- All applicants are treated equally with regard to being permitted to complete application forms.
- Minority group applicants are not kept waiting longer than non-minority group applicants.
- Application forms are not marked to indicate race.
- Application form questions are not designed to discover race, religion or national origin (color of hair or eyes, memberships in organizations, etc.)
- Applicants are not required to furnish photographs.
- Standards of eligibility for hire or selection are objective and clearly defined.
- Applicants' questions regarding standards of eligibility are answered.
- Applicants are notified of their eligibility or ineligibility.
- Interviewing personnel are qualified in the responsibility to evaluate capabilities and the task is not delegated to persons not qualified for the function, such as guards or receptionists. Ideally, there may be Negro or Spanish-speaking interviewers.

Personnel Testing

- Tests are job-related.
- Tests are validated for minority groups (no cultural bias).
- Written tests are not used exclusively to ascertain eligibility for hire or promotion.
- There is a single standard for rating tests.
- Minority group applicants are not tested when non-minority group candidates are exempted.
- Applicants are advised of the test scores needed for acceptance and of their own scores.

Placement and Lines Progression

- Employee classification and organization allows minority group employee full participation in promotion and transfer opportunity.
- There are no dead-end lines of progression made up exclusively or predominantly of minority group employees.
- Functions that have a normal place in non-minority lines of progression are not isolated into separate minority group lines.
- Minority group employees are properly classified, allowing a line of progression that will maintain their promotion opportunity.
- There are no discriminatory impediments to the movement into, out of, and within progression lines.
- All employees are acquainted with matters governing promotion, demotion, lay-off, or terminations.

Salary and Wage Plans

- Classification and compensation of minority group employees are equal to and consistent with that of non-minority group employees performing like work.
- Wage rates for jobs filled mainly by minority group members are the same as those occupied predominantly by non-minority group employees.

Training

- Minority group employees are neither excluded from training programs nor are they under-represented.
- Apprenticeship training is provided when such programs are needed to insure equal employment opportunity for minority group employees.
- Training programs are provided for minority group employees in helper positions.
- Training needs of minority group employees are determined through qualification review programs.

Employee Rating

- Employees are informed of the criteria against which performance is evaluated.
- Performance criteria and rating standards are nondiscriminatory against minority group employees.
- Procedures exist for employee appeal from an adverse performance rating.

Disciplinary Actions and Separations

- Employees are informed of policies and procedures governing disciplinary actions.
- A table of standard penalties has been established.
- Equal penalties are imposed for like offenses.
- All employees are given advance notice of disciplinary actions and are given opportunity to make reply to a specific charge.
- All employees are accorded an explanation of why his answer to a specific charge is considered unsatisfactory, before disciplinary action is taken.
- Disciplinary action is proportionate to the nature of the offense.

Segregation of Facilities

- Contractor policies and practices must insure that segregation of facilities will not occur.
- Employees are not assigned to work where facilities, under control of the contractor, are segregated.
- De facto segregation, through custom, is not tolerated.
- Facilities (wash rooms, locker rooms, time clocks) are not reserved for designated groups, either by sign or established practice or custom.
- The contractor denies sponsorship to any establishment, social center, golf course, swimming pool, etc., that follows a policy of exclusion of any minority group.
- The contractor denies sponsorship to any social or atheltic event at a private establishment that follows a policy of exclusion of any minority group.

Correction of Prior Deficiencies

- The contractor has taken satisfactory measures to correct compliance deficiencies noted in any prior compliance review.

12th Naval District Headquarters Moved to Treasure Island

Commandant, 12th Naval District, Rear Admiral Leo B. McCuddin, and his staff have moved from the Federal Office Building in downtown San Francisco to new headquarters at the Treasure Island Naval Station.

The move is in connection with a master plan for maximum use of Treasure Island that will consolidate naval activities in the area at a central location.

Since the Commandant, 12th Naval District, is also Commander Naval Base, San Francisco, and Commander, Central District Defense Group, Western Sea Frontier, the mailing address for all titles is now:

Building 450
Treasure Island
San Francisco, Calif. 94130

This address may also be used for the Naval Regional Finance Office which will occupy the same building.

The 12th Naval District is one of 15 naval districts, (including the Washington Naval District), that divide the continental United States and a few overseas areas into geographical sections. It encompasses the northern part of California, all of Utah and Nevada, excluding Clark County.

Navy Awards Contract for DLGN Frigates

Newport News Shipbuilding and Dry Dock Co., Newport News, Va., has been awarded a negotiated fixed-price incentive contract for the design and construction of two guided-missile nuclear-powered frigates.

Total target contract price is estimated at $143,500,000. Work will be performed at Newport News.

The ships will be equipped with the most advanced sonar and anti-submarine warfare (ASW) weapons, as well as two dual Tartar surface-to-air missile systems, providing an effective combination of both anti-air warfare and ASW capabilities. They will also be equipped with conventional naval guns providing multi-purpose escort capacity.

Army Expands Night Vision Center

The Army is expanding its Combat Surveillance, Night Vision and Target Acquisition Laboratories at Fort Belvoir, Va., with the construction of two buildings. One will serve as a night vision simulator building and the other as a far infrared laboratory.

Both projects are expected to be finished in September 1969.

Management Training Aids Help Strengthen Small Business Firms

Clyde Bothmer

[*Editor's Note: This is the fourth in a series of articles for small business defense contractors by Clyde Bothmer, Deputy Associate Administrator of the Small Business Administration.*]

The Small Business Administration's (SBA) management training program is closely related to the management counseling effort described in the preceding article of this series (see article "Management Counseling for Small Business," *Defense Industry Bulletin*, September 1968, page 27). That article pointed out that group counseling by management assistance officers is a principal method for providing basic information to a wide audience.

During the last fiscal year, SBA provided more than 2,500 units of training with an attendance in excess of 84,000. It would be impossible to properly counsel on a person-to-person basis the large groups implied by these figures. SBA's capability to inform potential and active small business owners and managers on an individual basis would be severely reduced without the material provided for small business management training: more then 800 titles on various aspects of management. Although the primary function of these materials is to train small businessmen, universal management principles are stressed in the publications, making many of them potentially useful to any manager who needs to fill in gaps in his education or experience.

The SBA management assistance materials are leaflets, booklets, and films. They are designed for three types of audiences: small business managers and potential managers, small business management teachers, and small business advisers.

All of these materials stress principles of management rather than operating techniques. A recent example of this emphasis is an article, "Should You Make or Buy Components," which was released in the Management Aid for Small Manufacturers series. This eight-page leaflet discusses the cost element which the owner of a small plant needs to examine when considering whether to make or buy. When he understands the principle, he can apply it to whatever changes advancing technology may bring to the manufacture of components.

Frequent approving comments from users about the authenticity of information point to another thing which SBA's management educational materials have in common. Authors are independent experts, writing from current, practical experience in their subject. They are encouraged to give pragmatic suggestions and "how-to-do-it" advice.

Since 1953, when the agency began publishing management assistance information, SBA's authors have come from accounting firms such as Haskins & Sells and Alexander Grant and Co.; from associations such as the American Marketing Association, the National Safety Council, and the American Institute of Architects; from banks such as the Chase Manhattan Bank and the First National Bank of Chicago; from companies such as Gates Rubber Co., American Optical Co., and American Telephone and Telegraph; from consulting firms such as H. B. Maynard Co., Sanderson & Porter, Inc., and Arthur D. Little; from universities such as the University of Denver, St. Edward's University, and the Harvard Graduate School of Business Administration; and from government agencies such as National Aeronautics and Space Administration and the Internal Revenue Service.

Publications for Small Business Managers

SBA publishes four leaflet series and two booklet series for small business managers or potential managers. Each seeks to fill a distinct need in the small business community.

Among the leaflet series, the oldest is Management Aids for Small Manufacturers. This series deals with the functional problems in small plants and concentrates on subjects of interest to administrative executives. More than 190 titles are published. Examples are "Using Census Data in Small Plant Marketing," "Measuring the Performance of Salesmen," and "Checklist for Developing a Training Program."

Another leaflet series of interest to members of the defense-industry team is Technical Aids for Small Manufacturers. This series is intended for top technical men in small companies. In many small firms, the administrative and technical officials are one and the same; in others there may be a technical specialist to supervise that part of the company's operations. Examples of titles are "Value Analysis for Small Business," "Inspection on Defense Contracts in Small Plants," and "Controlling Quality in Defense Production."

The remaining two leaflet series are designed for owners of nonmanufacturing businesses. One, the Small Marketers Aids, concentrates on subjects of interest to administrative executives of small, retail, service and wholesale firms. The other, Small Business Bibliographies, are devoted to individual types of businesses. Directed primarily to prospective owner-managers (individuals who seek to enter business for themselves), those bibliographies also include a description of operating procedures in the subject named business.

The Small Business Management series is the oldest of the three booklet series that are primarily for the individual reader. These booklets present a more comprehensive discussion of special management problems in small companies than is possible in an eight-page leaflet. Of the 33 volumes, typical titles are "A Handbook of Small Business Finance," "Ratio Analysis for Small Business," "Profitable Small Plant Layout,"

and "Small Store Planning for Growth."

The Starting and Managing series of booklets differs from the other booklets in that each volume describes the problem of starting and operating a specific type of enterprise. The single exception is the first volume in the series, "Starting and Managing a Small Business of Your Own," which is general discussion. Examples of titles are "Starting and Managing a Service Station," "Starting and Managing a Small Automatic Vending Business," and "Starting and Managing an Aviation Fixed Base Operation."

The Aids Annuals series of booklets furnishes the small business owner-manager with a permanent source of the material originally published in the Aids series. The 24 volumes in this series are compilations of individual issues from the three Aids series. The Management Aids for Small Manufacturers Annuals and the Small Marketers Aids Annuals contain publications from their respective series published during a previous year. The periods covered by the Technical Aids for Small Manufacturers Annuals are somewhat longer.

Publications for Small Business Teachers

SBA publishes various educational materials for small business teachers—individuals who instruct in management courses which SBA cosponsors with universities, business schools, trade associations, and other organizations.

One example of this type of material is the Coordinator's Kit. In addition to containing information on methods for starting courses, this kit offers teaching aids. Among them are case studies, lectures, and outlines.

Management Course Presentations are another type of materials for small business teachers. Covering various management subjects, each volume is designed to help the course leader in preparing one or more sessions on a particular management subject. The package includes a teaching outline, a text, visual aids, handout materials for class members, case material, suggested homework assignments, and a bibliography. Examples of titles are "Personnel Management: Developing Good Employees," "Effective Advertising," "Safeguarding Your Business and Management Succession," and "Why Customers Buy (and Why They Don't)."

SBA also provides scripts and visuals for overhead projection for workshops for prospective small business owners. The agency has a series of color films on advertising and sales promotion. Produced to SBA's specifications by an outside contractor, typical titles are "The Advertising Question" and "The Calendar Game."

SBA also produced a series of black and white films which deal with various aspects of management. Ten films make up this series which tells the story of a young man who seeks advice on going into business for himself with the money he has inherited Examples of titles are "Functions of the Manager," "Purchasing, Pricing, Inventory Control," and "Planning for the Future." This series is also available on tapes for television broadcasting. The movies and tapes are loaned for SBA co-sponsored training sessions.

Materials for Small Business Advisers

Two series of printed material have the purpose of informing small business advisers—accountants, lawyers, bankers, consultants, and others who work closely with the owners of small companies—the Small Business Management Research series and Management Research Summaries.

The booklets in the Small Business Management Research series represent the results of academic or other professional research projects on small business management. They provide information which individuals serving small business can use in working with the owner-manager. Typical titles are "The First Two Years: Problems of Small Firm Growth and Survival" and "Interbusiness Financing: Economic Implications for Small Business."

The Management Research Summaries leaflets summarize the findings of reports published under the 1959 and 1960 SBA grant research programs. Summaries cover a wide variety of subjects in the broad area of managing, financing, and operating small business enterprises and are of especial interest to consultants and others who advise small business. Some typical titles are "Small Plant Turnover and Failure," "Finding New Products for Small Manufacturers," and "Financing Problems of Small Manufacturers."

SBA Staff Edits Publications

SBA provides editorial services because authors of the material are active specialists in management and not usually professional writers. These services make an author's job easier and help insure high quality.

When an author's manuscript is received by the Education Division of SBA's Office of Management Assistance, it is edited for approach, content, clarity, and factual accuracy.

The edited manuscript is then sent to outside experts in private and public organizations for review. In order to obtain a diversity of viewpoint and experience, there are as many as four reviewers. Often one is a university man, another a business executive, a third may be a professional (lawyer, accountant, management engineer), and a fourth may be a trade association executive or an official in another Federal agency. Reactions from all these people are studied, compared and evaluated.

The SBA's management assistance leaflets are distributed free, new editions being mailed to readers who have requested this service. Copies of leaflets and lists of free or for-sale publications are available also from the SBA Central Office in Washington, D. C., or the nearest SBA Field Office. Management assistance booklets are sold at nominal prices by the Superintendent of Documents, Government Printing Office, Washington, D. C. 20402. SBA leaflets and booklets are in the public domain. They carry no copyright; so they may be reproduced by individuals or organizations, which increases their availability to the general public.

All of these management training materials are oriented to providing information which will be applicable and helpful to the manager, whether he is studying alone or participating in a group counseling session. It should also be apparent that the applicability of the material is not usually restricted to small business. This training does help strengthen the management of the suppliers and customers of big business and the public; but it also could be easily applied to developing the management capabilities of the large firm as well. A thorough grounding in the principles emphasized by these training materials provides knowledge which can be applied to the problems of any business.

Military Strength Best Deterrent to Aggression

Address by Hon. Clark M. Clifford, Secretary of Defense, at the National Press Club, Washington, D. C., Sept. 5, 1968.

Last Sunday [September 1] marked the end of my first six months as Secretary of Defense. Accordingly, this is an appropriate occasion on which to review briefly with you some of my principal impressions about this position and some of the major events of my half year in office.

It seems even clearer to me now than it did at my confirmation hearing last January that my primary responsibility as Secretary of Defense is to seek to assure the survival of this nation no matter what the strength of any of its enemies. Others within and without the Government are free to work unqualifiedly for the best of all possible worlds. The Secretary of Defense must make certain that we are prepared for the worst.

I find this responsibility neither uncongenial nor unrewarding. Because, as I see it, an America that is strong militarily is neither a provocateur nor a potential aggressor. Our military security provides instead the best available deterrent to military adventures by those who might otherwise see how far they could go.

That belief underlies the views I expressed in my confirmation hearing on the issue of our position relative to the Soviet Union in the field of strategic nuclear weapons. I indicated my intention to seek diligently to preserve our margin of advantage. The same motivation governed the position of the Defense Department on the efforts of some in Congress to defer or even eliminate the deployment of our Sentinel anti-ballistic missile system (ABM). Recently we were also faced with a somewhat comparable decision in connection with the testing of our newest developments in the nuclear missile field. This series of tests involves the principle of multiple independent re-entry vehicles (MIRVs). We were extremely gratified by the results of the initial tests of our Minuteman III and Poseidon missiles.

In both these instances, we have proceeded with these new, and admittedly very expensive, weapons developments not with the idea that war is inevitable. Instead we have done so on the basis that a position of substantial strength is essential and is the best position from which we can negotiate agreements that may make the threat of nuclear war increasingly remote.

There have, of course, been those who have disagreed with this approach. For example, in the course of the controversy over Sentinel, there were those in our Congress who insisted—and I am sure that they did so in all sincerity—that our proceeding with this ballistic missile defense would lead to "very dangerous countermeasures by the Soviet Union," that it would ignite a missile defense race, and that it would "be positively harmful in its effect upon the growing possibility of discussions between the United States and Russia in regard to the limitations of armaments."

I did not share these fears. We had made it clear that the Sentinel ABM defense was designed primarily against the Chinese threat and could not cope with a massive Soviet attack. Moreover, I felt and continue to feel that, with the Soviet Union having for some time been engaged in the actual deployment of a ballistic missile defense, our decision to go ahead with our own system would both improve the chances of talks and the negotiating climate should such talks take place. Whatever the thinking of the Soviet leaders may have been, the Senate's rejection of the attempt to cut off construction funds for the Sentinel certainly did not delay the Soviet decision to start talks on strategic weapons. Just four days after the Senate action, we received for the first time acceptance of our long-standing offer to talk with the Soviet Union about curbs on nuclear weapons.

We can continue to hope that, at an appropriate time, these talks can take place. In the meantime, I am confident that our decision to proceed with the very important tests of our MIRV principle does not prejudice the prospect that such talks would be fruitful.

I am also proceeding with another decision. I have today directed that the Sentinel ABM system be exempt from the expenditure reduction program required by Congress for FY 1969. From a financial standpoint, the option to reduce Sentinel expenditures could have been useful. I have determined, however, that in the light of all current developments our prudent course is to press forward as planned with the Sentinel system.

Justice Oliver Wendell Holmes once said, "The life of the law has not been logic: it has been experience." One's views are probably at least as much the product of experience as they are of logic. And my own deeply held belief in the importance of dealing from strength has not resulted from the past half year alone, but stems also from my experience with the Administration of President Truman in the period following World War II.

Those were the years in which our hopes that the Soviet Union would cooperate out of good will and common aims in a world of free nations turned out rapidly to be pure illusion.

We found that the dismantling of our military machine was matched by no comparable action on the part of the Soviets. Instead, they exhibited their intention to move in whenever and wherever situations of weakness could be found. We rapidly learned that we could meet this challenge only through such creative actions as the Truman Doctrine, under which we helped provide Greece and Turkey with the means to resist the pressures of communist expansionism. Then there was the Marshall Plan, which enabled the war-drained countries of Western Europe to rebuild their shattered economies. Perhaps most important of all, the North Atlantic Treaty Organization presented the Soviets with an array of free nations firm in their determination to present a collective defense to any further Soviet probes.

My personal participation in the years when NATO was formed unquestionably has influenced my reaction during the past six months to suggestions that the number of American troops in Europe should be drastically reduced. Admittedly the more than 300,000 American servicemen who are now in Western Europe, more than 23 years after the end of World War II, represent a substantial expense for the American people. But the cost is dwarfed when one compares it to the enormous cost of American lives and treasure expended in a general war, or to the consequences if America were to be isolated in a hostile world.

We should not, in my view, be led by NATO's success into the delusion that a strong U. S. military contribution to NATO is no longer necessary. Some had thought, and there had been some signs that justified such thinking, that today's Soviet Union was a far better neighbor than the Soviet Union of the late 1940s.

The events of the past couple of weeks, I submit, have clearly demonstrated that a significant American military presence in Western Europe is still needed. At the same time, our NATO allies surely must review these events from the standpoint of the effect upon our common security.

The developments of these last few days confirm the fact that, when and if we negotiate, safety and success demand that we negotiate from strength.

We would hope at an appropriate time to begin to discuss with the USSR a limitation on both offensive and defensive nuclear weapon systems. Such discussions could lead to an understanding which, at a minimum, would enable us to check the spiralling cost of nuclear arms with no diminution in our national security. The non-nuclear powers, of course, would welcome any evidence of mutual restraint. Such an agreement would also significantly encourage adherence to the Nonproliferation Treaty which both we and the Soviet Union regard as an important safeguard against the nuclear outbreaks that could jeopardize the civilized existence of mankind.

The events that have occurred, and the decisions that I have faced during my half year in office, thus reinforce my fundamental belief that our long-range hopes for peace, and for peaceful co-existence, rest in the continued military strength of the United States.

These months have also seen developments that provide a basis for hope that we can find a solution to our most vexing short-range problem—peace in Vietnam. Contrasting where we were on March 1 with where we are today, there are three important elements in this more hopeful prospect. First and most important was President Johnson's statesmanlike initiative in his March 31 speech, in which he courageously took the first step toward peace by limiting the bombing of North Vietnam to the infiltration routes in the Panhandle. This action led to the Paris peace talks. The talks thus far have produced no settlement but they are continuing. As Hanoi faces up to the futility of further attempts to take over the South by force, we may see some movement that will bring peace closer.

Hon. Clark M. Clifford

The second element in the new look since March was the decision that U. S. troop strength in Vietnam could be limited to 549,500. We have been assured by General Abrams, and our commanders in the field told me personally during my July trip to Vietnam, that this strength, together with the forces of the South Vietnamese and our allies, is sufficient to withstand and defeat any offensive that the enemy can mount. Our effort in South Vietnam can now be seen not to be an unlimited drain on our resources. The so-called "bottomless pit" has been capped.

The third and final element in the changed complexion in South Vietnam is the progressive development of our policy to prepare the armed forces of Vietnam to take over a greater share of the burden of the continuing battle if peaceful settlement continues to prove elusive. During the past six months, we have steadily improved the firepower of the Regular Forces and many of the Regional and Popular Forces as well are armed with the M–16 rifle. Our ability to equip all the South Vietnamese combat and combat support troops with this latest and best in shoulder arms is facilitated by the fact that M–16 rifle production is now two and one-half weeks ahead of an already accelerated schedule. Initial deliveries from our two new sources are now expected to arrive more than a month ahead of the scheduled date of February 1969. The armed forces of South Vietnam will continue to receive priority allocation of these weapons. As you know, M-16s are already in the hands of all our American combat troops who are performing so magnificently in Vietnam.

Together, these three developments have put us in a far stronger position to bring our Vietnamese involvement to a satisfactory conclusion.

Finally, I would like to dwell briefly on the special problem of discharging our fundamental responsibility of ensuring the national security at a time when the military means of doing so have become increasingly expensive and when the competing demands on the budgetary

dollar have multiplied. As a result of the Congressional mandate that the 10 percent surtax be accompanied by a $6 billion reduction in Federal expenditures, we must cut $3 billion out of our defense expenditures for this fiscal year. Several of the steps in this program, which we refer to as Project 693, have already been announced. Obviously the programs, facilities and units eliminated as a result of the restrictions imposed by Congress have represented some reduction in our military posture. They must not, however, despite the obvious difficulties, involve any dangerous impairment of our overall security, or seriously diminish our ability to meet the international treaty commitments which constitute a vital part of that security.

But the financial stringencies under which we must now operate make it more important than ever that we get the maximum value for every defense dollar that we spend. In this effort, we will be aided greatly by a major expense accounting system which we have now adopted in the Defense Department. We call this new system Project PRIME. With PRIME, the commanding officer and every department head at a base will know the cost of military as well as civilian personnel, and the costs of all kinds of services and supplies that are used on a current basis. With this kind of information available quickly and reliably, the commander will be better able to make wise choices in the use of his limited budget funds. PRIME also includes a uniform set of accounts for classifying costs, so that managers at all levels in the department can make useful comparisons. This uniform set of accounts will also help me and others who make choices between major programs, because we can be more confident about the relevant cost of competing programs. PRIME is a significant step in applying businesslike methods to the operation of the Defense Department.

We live in an imperfect world. From the standpoint of our national security, we know not what lies ahead of us next week, next month, or next year. I say to you that our hopes for the future, as well as the lessons of the past, suggest that the rock of power must be the foundation for the house of peace.

Space Beyond the Threshold

Address by Lt. Gen. Joseph R. Holzapple, USAF, Dep. Chief of Staff for Research and Development, U.S. Air Force, at the Second National Conference on Space Maintenance and Extravehicular Activities, Las Vegas, Nev., Aug. 6, 1968.

It is, indeed, a great pleasure to keynote the Second National Conference on Space Maintenance and Extravehicular Activities. This conference can serve the continual needs for fresh perspectives and for cross-stimulation so basic to scientific and technical progress. And there can be no question that the conference co-sponsors—the National Aeronautics and Space Administration and the Air Force Aero Propulsion Laboratory—have developed a program that will well serve those needs.

I think all of us tend to get wrapped up in the hurly-burly of everyday problems. So, from time to time, we simply reach the point where we need briefly to stand aside and take a fresh look, and do some fresh thinking.

I suppose that, over the next several days, someone will inevitably observe that mankind is really only at the threshold of space. I might be tempted to be the first to make this observation. The trouble is I am not at all sure it is true.

I am not sure it is true because I am not sure what it means. If what we really have in mind is the state of our space technologies, then I think that we are already well beyond the threshold. But if we have in mind attitudes toward space, then I think it is entirely possible that we are just barely approaching the threshold.

On the surface, this may appear to be an abstract distinction. Yet it bears vitally on a concern we must all share this morning. Our concern cannot simply be with current technical problems or even with present funding problems. Our inevitable concern must always be with the direction of the national space program over the longer view. I frankly think we cannot long proceed intelligently in space if attitudes lag technologies. So now is the time to take a hard look at some key attitudes toward space.

Thus far, the national space program has been propelled largely by the momentum of that mass of technology set in motion by the urgent needs for the ballistic missile, and has been speeded by such stimuli as Sputnik. These have been the exciting early years, rich in the drama of suspense and adventure. These have been the threshold years of space technology—the glamor years of public enthusiasm and public funding.

In the short span of 10 years, this momentum has carried us from those first tentative unmanned space launches to the point where we are already deeply concerned about the direction of our space program beyond the first manned lunar landing.

This is how far the initial momentum has carried us and, of course, we have learned much. But this kind of momentum could not forever continue. We have now well passed that phase in the space program—common to any wholly new scientific endeavor—where technical possibility is its own best justification.

It is, of course, still true for space, as for most areas of technical challenge, that many of the more exciting technical possibilities for the future will stem from insights and discoveries we cannot now even imagine.

But it is true, also, that the scientific search for new possibilities can only be sustained for a limited time, if there is not at least an equally determined search for beneficial applications. The search for applications demands that you lead your technologies, as opposed simply to following them.

The idea of funneling scientific and technical effort into specific applications is not always greeted with marked enthusiasm. In fact, the idea runs counter to a strongly held attitude, especially where space is concerned. This is the feeling that there is the risk of missing unsuspected possibilities if there is heavy concentration on those technologies that already have well defined applications.

Thus, there is a tendency to overlook that fact that the process of leading technologies toward specific applications may, itself, have the effect of opening up new possibilities. Strong direction need not necessarily inhibit scientific and technical innova-

tion. This attitude also tends to forget the fact that our scientific and technical programs in space are not being conducted for their own sake. The ultimate function is to solve problems, or to meet urgent needs, or to open new vistas for human benefit. This is precisely the function of such programs as Apollo Applications and the Manned Orbiting Laboratory. With these programs we are moving somewhat away from basic experimentation and more in the direction of uses and applications in space.

We can all welcome this as a very healthy trend. It is entirely probable that some of the funding problems for some of our space programs will be bridged when the applications are more fully recognized and understood. Very much contrary to another popular attitude—that Vietnam is the source of most of our funding problems—I think the more significant source is the need for a better understanding of possible applications in space, and their true benefits.

I might add, parenthetically, that almost everyone in Government who is confronted with funding problems—and there are few who are not—is likely to point to Vietnam as the source of his difficulty. There is no denying that Vietnam is having some impact. However, I suspect that anyone who is expecting a sudden flow of funds into his particular program the moment the war ends, is liable to be disappointed. In any event, this is almost certain to be true where space is concerned.

Where funding is involved, there can be no doubt that the space program is well beyond the threshold. It is not really that the sense of urgency has gone out of the space program, or even that is has lost much of its romance. The problem, if it can properly be called a problem, is that our nation is tackling a wide range of urgent and demanding challenges. What has happened is that the space program has simply reached a new maturity, and is finding its proper place in the perspective of all of our national challenges. This should not be alarming. The fact that the space program will have to compete even more vigorously with other demands on our national resources may, in the long view, greatly benefit it. This kind of discipline forces even more advanced and creative thinking.

In relation to the somewhat more competitive environment in which the space program will likely function for funding, there seems to be some renewed concern that the economic factor will place too many space programs at an unfair disadvantage. The feeling may be that innovations in space are anyone's guess and that if they can't be predicted, then neither can their costs. Costs, of course, have to be based on the proven or tested. There is no way to predict costs on the more "high risk" technology programs, where technical problems and system capabilities may be largely unknown. So the effect could be to reduce or eliminate risk taking and this may, in turn, close the door on truly dramatic but unrecognized possibilities.

There is no denying that this is a problem.

However, I think the problem is easily exaggerated. Moreover, experience has shown that the place to explore risks is at the basic technology level. Promising possibilities surface here, and this is where "risk capital" is invested with a view toward eliminating the risks as fully as possible. Generally, the need to take severe risks is eliminated by the time a major hardware program is initiated.

Space Effort Benefits Economy

As for space competing for funding on the basis of economic benefit, there is every reason why it should compete very successfully. There is ample evidence that space applications will shortly, if they have not already, provide economic returns that can match, or perhaps exceed by as much as two to three times, the annual national investment in space, both public and private. This does not take into account the economic return to the nation of such factors as new space-oriented industries. Interestingly, very few people were seriously thinking in terms of space providing an economic return until very recently.

Precise figures are still largely lacking. Nonetheless, the evidence is clear. For example, a study conducted for the National Academy of Sciences pointed to the very high value of meteorological data from the Nimbus and Tiros satellites, and the newer ATS satellites of the Department of Commerce. These data have encouraged the development of mathematical models to simulate atmospheric systems on a global scale. The study indicates that weather and atmospheric data, relayed instantly to computers programmed on mathematical models, could make possible accurate weather forecasts for periods of up to 10 days, and perhaps more. It is estimated that the value of such very long-range forecasts to agriculture and the construction industry, alone, could be in the range of about $800 million a year. It is not difficult at all to visualize the dramatic value that could accrue in such areas as geological survey, aviation, and shipping. As a matter of fact, I can see some real possibilities there for the entire vacation and resort industries, for that matter.

Weather observation is just one significant economic benefit. Communications is another. There is no question that the cost of new satellite communication systems compares much more than favorably with the costs of new trans-oceanic undersea cables, or cross-continent underground and suspended cable system. I understand that AT&T is currently estimating that a combined, space-based telephone-television system, just for the domestic needs of the United States, would result in an investment savings of about $200 million by 1980.

So any argument that the space program cannot compete on economic grounds is apt to prove woefully shortsighted. In fact, it seems to me that one of the strongest cases for support of the space program in the coming years is going to be the economic case. Like aviation starting in the late 1920s, space in the mid-1960s

Lt. Gen. Joseph R. Holzapple, USAF

promises to open a vast new arena for economic growth. This translates in terms of new jobs, new challenges, and new possibilities.

Realistic Cost Estimates Needed

There is, of course, another aspect of the economics of space. Until rather recently, all of our space programs advanced in a comparatively uninhibited cost environment. This is not to say that no one was thinking about costs, or worrying about them, or attempting to hold them down. On the contrary, this has been a continuing and critical concern. The problem was that we had almost no technical alternatives and even less experience. If we wanted to get into space at all—if we wanted to develop a learning curve—then we had little choice other than to proceed the way we did. From the technical standpoint, the risks really were not all that great. But we knew little about how to predict some of the costs.

Today we have a solid learning curve. We know a great deal more about how to predict costs, and we also know a number of ways by which we can cut or eliminate certain costs. Consequently, we are at the point where it is realistic to demand that every program be fully justified in terms of benefit in relation to cost. In preparing proposals and in advocating systems for space, we can address the subject of costs with far greater confidence. This is to our advantage.

Moreover, NASA and the Air Force can now move even more in the direction of commonality and of multi-purpose designs with the aim of reducing costs. Not that this is entirely new: The man-rating of the Air Force Titan II for use with the NASA Gemini is a case in point. Similarly, Gemini is a vital element of the Air Force Manned Orbiting Laboratory (MOL).

However, the trend will be even more pronounced. At the present time, in fact, NASA and the DOD are jointly studying possibilities for joint use of manned and unmanned space systems. One possibility, perhaps, might be a multipurpose spacecraft suitable for support of the missions and programs of both NASA and the Air Force. Such dual mission systems, if feasible and effective in terms of the needs of NASA and the Air Force, would result in substantial savings.

Looking a bit further ahead, a very large payload space system might serve specialized missions with highly specialized instrumentation, a ferry run to place support systems in orbit for a future mission, and a resupply mission all on the same launch.

As you know, both NASA and the Air Force are especially interested in the re-use of recovered spacecraft. We have already had some success in this area on a small scale. You may know, for example, that a recovered Gemini has been used in testing a heat shield for the MOL program. But on a much larger scale, our preliminary studies indicate that there could be very substantial savings in the reuse of entire spacecraft, even though the initial costs may be higher.

We are really just getting into the potential economies of re-usable systems. We have been considering various propulsion modes for re-usable boost systems for several years. Much of this is vital conceptual and theoretical work.

The whole matter of re-entry and landing has been of considerable interest. Current recovery techniques, involving direct impact either on water or on land, appear to involve too many shocks that cannot easily be eliminated. Moreover, air recovery by parachute appears to be limited by weight considerations, at least for the near future. So we are keenly interested in large payload boost systems and spacecraft that would have the capability of landing in much the same way as a conventional aircraft.

In line with this, NASA and the Air Force have been conducting joint lifting body tests, principally using the X–24A. The results have been encouraging, but there are still problems. Frankly, the idea of a night or weather approach at 250 knots in an X–24, which has no go-around capability, does not send me to the locker room for my flight suit. What we will want in the actual operational space system is the capacity for conventional landing, combined with the ability to go-around or remain in a holding pattern.

The message in all of this is that economies for space systems are not only possible but technically desirable. Those who still hold to the view that you cannot do anything in space without virtually unlimited funds need to adjust their thinking. We can do a great deal in space very economically. And we are going to do just that.

Man's Role in Space

We come, now, to one of the thorniest problems of all. This is the attitude that unmanned near-earth-orbit space systems may have a role, but that man in space has no role. I will not, here, recount the many familiar arguments in support of our manned space programs. This touches on a subject closest to you because you, better than most, know how crucial man is for space maintenance, and what some of his potential extravehicular roles are.

In view of the broad range of space possibilities and the limited degree to which they have yet been explored, the question we should logically ask is simply under what circumstances can man do a better job, how much better, and at what additional cost. This is a key question, and one we must answer in the crucial post manned lunar landing decade.

We cannot ignore man in space and still remain technically competitive in space. However, this is not the only compelling reason to consider man's role in space.

There is the matter of national security. I think there is no nation in the world more intent than ours on wholly peaceful space uses. This deep intent must not lead to the fallacy of ignoring one hard fact: There are potential military applications for space. This is not to say that we need, therefore, deploy hostile space systems. It is simply to say that we should identify the potential threats, and be able to counter them if need be.

In this connection, at the present time, one of the most urgent needs is to quantify military man's role in space. I think that more people need to understand that all of our military programs in space, manned or unmanned, have this basic objective: to make any hostile military applications entirely unattractive as a military expedient. More people need to think through the attitude that any military study of possible military

applications in space will necessarily invite hostile military applications. The effect is much more likely to be precisely the contrary.

I have talked about some of the current attitudes toward space, and of my own views in their connection. There are, of course, other attitudes that I have not addressed at all. Some of them may be obvious.

I have not, for example, discussed the often expressed feeling that space is essentially the arena of the large corporation and of the large design team. This is a classic misconception. We look back, now, on such "little" problems as eye irritation, the crying need for handholds, and unexpected profuse perspiration during some of the earlier Gemini extra-vehicular activity missions. We know that the answers to these kinds of problems are most likely to come from the smaller companies, or from a single engineer or scientist.

So no one has an exclusive claim on space. Space is a truly national challenge. We have essentially mastered the technology of space access and have made significant steps toward applications in space.

But the real path through and beyond the threshold of space is not the path of technology itself, but of human daring—of our ability to look well ahead of current technologies, and of current applications, for truly dramatic advances and benefits.

The challenge of space cries out not just for huge, talented, and well managed design teams, as important as these are. It cries out even more for the imaginative and the creative who are not inhibited by the past or intimidated by the future, who are prepared to think unconventionally and positively, and, above all, who are prepared to help drive the space program toward a future we cannot now even foresee.

Ogden AMA To Support Maverick Program

Logistic support of the Maverick missile has been assigned to Air Force Logistics Command's Ogden Air Materiel Area, Hill AFB, Utah. Development of the new missile is under the management of Air Force Systems Command's Aeronautical Systems Division, Wright-Patterson AFB, Ohio. Hughes Aircraft of Culver City, Calif., is the development contractor.

About People

(*Continued from page 20*)

Air Force Systems Command.

Brig. Gen. William S. Chairsell, Asst. Dep. Chief of Staff (Systems), AFSC Hq., Andrews AFB, Md.

Col. William K. Bailey, Dir. of Production, Air Force Contract Management Div., Los Angeles, Calif.

Col. George T. Galt, Dir., Aerospace Instrumentation, Electronic Systems Div., L. G. Hanscom Field, Mass.

Col. Robert J. Kuehn, Dep. for Communications Systems, Electronic Systems Div., L. G. Hanscom Field,

Col. Joseph H. Myers, Dir., Air Force Flight Dynamics Laboratory, Wright-Patterson AFB, Ohio.

Col. Frederick C. Newton, Dir., Procurement and Production Office, Electronic Systems Div., L. G. Hanscom Field, Mass.

Col. Charles H. Peterson, Chief, F-5 and T-38 Systems Program Office, Aeronautical Systems Div., Wright-Patterson AFB, Ohio.

Col. James W. Rawers, Dir. of Information, AFSC Hq., Andrews AFB, Md.

Col. Kendall Russell, Program Dir., Airborne Warning and Control System, Electronic Systems Div., L. G. Hanscom Field, Mass.

Col. Paul M. Spurrier, Dep. System Program Dir., C–5A Program, Aeronautical Systems Div., Wright-Patterson AFB, Ohio.

Col. Roy H. Worthington, Dir., Space and Ballistic Programs, Office of Dep. Chief of Staff (Systems Development), AFSC Hq., Andrews AFB, Md.

Air Force Logistics Command.

Col. Virgil H. Rizer, Chief, Aircraft/Engine Procurement Div., Oklahoma City Air Materiel Area, Tinker AFB Okla.

Office of Aerospace Research.

Col. Dale J. Flinders, Commander, Air Force Cambridge Research Laboratories, L. G. Hanscom Field, Mass. Mass.

Col. William K. Moran Jr., Vice Commander, Aerospace Research Laboratories, Wright-Patterson AFB, Ohio.

Army Seeks Ideas for POW Identification Device

The Army is looking for ideas for a POW identification device that will prevent captured enemy troops or suspected partisans from switching names to confuse interrogation and confinement officials.

High priority is being placed on development of a band that will clearly show when it has been removed or altered.

In addition to preventing POWs from concealing or falsifying their identities, the band and banding devices may have secondary uses in assuring identification of casualties, stragglers, internees and, in some operations, entire populaces of towns.

The equipment should not take more than 45 seconds per band to attach and require no new skills. It should not be applicable for use by prisoners as a weapon, signalling device, or hiding place.

Tropic tests are now being performed for the Army's Combat Developments Command, Fort Belvoir, Va., to determine which concept meets the essential and desirable characteristics for wristbands and tamper-proof attachments.

Nike-X Development Office Established at Redstone Arsenal

The Army has established a Nike-X Development Office (NXDO) at Redstone Arsenal, Ala., to insure the adaptability of the Sentinel Ballistic Missile System to changing threats.

The new research agency will be organized into five divisions. Technical areas to be studied by the office include radar development, systems requirement and threat, missile development, reentry physics and range measurement research, and optical systems development.

Julian Davidson, a civilian scientist and former head of the Nike-X Development Group, will head NXDO.

NXDO is a field agency of the Army Advanced Ballistic Missile Defense Agency, headquartered in Washington, D.C. It will be co-located at Redstone Arsenal with the Sentinel System Command to insure maximum exchange of information between the two development efforts.

U. S. NAVY

Guidelines for Developing and Submitting Unsolicited Proposals

The unsolicited research proposal is a document initiated and submitted by a prospective contractor to one of the agencies of the Navy Department with the objective of obtaining a contract to perform basic research, applied research, or exploratory development.

Unsolicited proposals are usually the result of a decision by a prospective contractor that he has conceived something new or novel and that, if sponsored, he can demonstrate that the idea has both scientific merit and a naval application.

In general, such proposals fall into one of three categories:

- Basic research proposals to perform work which will contribute a fundamental knowledge in a scientific area.
- Applied research proposals to use existing scientific knowledge to provide a new naval capability or substantially improve an existing capability.
- Exploratory development proposals to undertake investigations and studies to demonstrate new techniques in naval functional areas or feasibility of a system, subsystem, or component.

The Pre-Proposal Stage

Before any kind of a proposal document is prepared, consideration should be given to what might be called the "pre-proposal" stage to avoid unnecessary spending. Since at this stage there is no certainty that financial support is forthcoming, it is wise that preparatory work be limited to the essential elements of the proposal required to get the idea across clearly and concisely.

The potential contractor should first sort out the obvious technical barriers in his proposal and try to acquire sufficient technical data to indicate that the problems are soluble.

Occasionally, a present contractor may propose research conceived independently of a currently held government contract, but which has not actually been developed and tested. In such cases, consideration should be given to the rights to the invention which the Government will acquire if the invention is built and tested under the contract. At the least, the contract will require the grant to the Government of a royalty free license to use the invention for governmental purposes. In some circumstances greater rights, including in some cases the grant of outright ownership, may be required.

After the prospective contractor has assembled enough information to adequately describe a new or novel concept, to indicate the approach necessary to solve the obvious technical problems and, if possible, to describe the ultimate military applications, he is ready to prepare a preliminary proposal.

The preliminary proposal should, in general, follow the format described in Figure 1, with the exception that at this stage detailed information is not necessary for sections f, g, and h. The same format will be used for the submission of the finalized unsolicited proposal but with more detail, particularly in the last three sections.

The Submission Stage

The next step in processing a preliminary proposal is to determine the agency, and individuals in that agency, having an interest in the proposal.

The Navy has published two pamphlets which will be useful in establishing contact with the office of primary concern regarding various proposals.

The Office of Naval Research has prepared a publication titled, "The Office of Naval Research Contract Research Program," which gives a general outline of the many scientific disciplines of interest to the Navy. The booklet also contains addresses and telephone numbers of the field organizations of the Office of Naval Research. In addition, the publication contains the telephone numbers of scientists that have cognizance over particular fields of interest. The booklet may be obtained, upon request, from the Office of Naval Research, Code 622, Room 4128, Main Navy Building, 18th St. and Constitution Ave., N.W., Washington, D.C. 20360.

The second Navy publication of interest is titled, "Navy Small Business and Economic Utilization Personnel Directory," (NAVSO P–

Format for Submitting Unsolicited Proposals

a. One-page summary statement of the proposed work.

b. A definition of the military application or field of interest and some indication of performance increases which might result.

c. A summary of the state of the art in the area.

d. A reasonably complete technical description of the proposed work, including a specific work statement and relationship of the proposed work to other work in the same field.

e. Names and background of principal investigators and associates.

f. Estimated duration of project and yearly budget including an estimate of cost of capital equipment and expendable supplies.

g. Facilities required and knowledge of availability.

h. Other government-sponsored work in the same area being undertaken by the activity.

Figure 1.

2485). It contains the names, addresses and telephone numbers of all Navy small business specialists. These people are familiar with the total Navy picture and may be of assistance in establishing initial contact. The book is available from the Office of Assistant Secretary of the Navy (Installations and Logistics), Room 2049, Main Navy Building, 18th St. and Constitution Ave., N.W., Washington, D.C. 20360.

In the event basic research or development work is not involved in the proposal, there is a publication titled, "Selling to the Military," which lists all of the military establishments that generate requirements of any nature. Copies can be obtained from the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402, for 30 cents.

The next decision to be made is whether the preliminary proposal should be mailed to a Navy agency or a personal contact made to discuss the document. If it is at all possible, it is more advantageous to make one or more personal contacts to discuss the proposal with interested individuals. The conversation type proposal discussion makes it possible to obtain detailed comments and suggestions which are difficult or impossible to incorporate in correspondence.

Don't Be Discouraged

One source of discouragement to the prospective contractor is the referral from one office to another in the search for the office or individual who is interested in the area covered by a proposal. This is often referred to as the "bureaucratic runaround" by individuals who don't understand the problem. The Navy and the other Military Departments are large, complex organizations consisting of central and field activities with various responsibilities and interests. It's often a chore, even for experienced employees, to locate an office or individual in a particular department, with a specific responsibility. The prospective contractor should accept the fact that, in many cases, it will require some effort to locate the office or individual who is in a position to evaluate his preliminary proposal.

In any review of a preliminary proposal, either by correspondence or office discussion, the prospective contractor should carefully note any specific technical objections or reference to lack of military application. It is usually pointless to prepare a final proposal if it does not contain sufficient information to contradict to some degree those objections. Preliminary discussions often reveal information which may make it advantageous for the prospective contractor to slightly alter his original concept, so that his work will more nearly conform to a military requirement of which he was orginally unaware.

The Re-evaluation Stage

After the preliminary proposal has been thoroughly reviewed the prospective contractor must evaluate the results of this review to determine if he should submit a formal proposal. Many important questions must now be answered. Was there sufficient interest to justify the expense of a formal proposal? If the reviewing office indicated an interest, was there any reason to suppose that funds were available to support such an effort? Did the reviewing office suggest that the submission be delayed until the next fiscal year when funds will be available? If the concept has a military application, should it be submitted to the Navy Department or some other Military Department?

The Formal Proposal Stage

If the prospective contractor has decided to submit a formal proposal, it is often satisfactory to use the preliminary proposal as the basic structure embellished with additional details. Excellent features of an unsolicited proposal may receive little attention, if the technical information and format are not adequate to convince the prospective customer that the proposal is worthy of acceptance.

One of the factors which influence the acceptance of a proposal is the arrangement of technical groups within a research organization. Scientific disciplines are well defined, and an unsolicited proposal for basic research in a scientific area is usually reviewed by an investigator who is trained in the related discipline. This arrangement assists in processing basic research proposals. Occasionally interdisciplinary proposals appear, but they are the exception rather than the rule. Organizations which support applied research and exploratory development are not as sharply delineated as the basic research organizations, and it is usually more difficult to find the cognizant group.

In addition, any proposal which has a military application should be based on a careful investigation of the following aspects of the work:

- Is the military application a new one or an improvement of current practice?
- If the miltiary application is a new one, does it appear that the successful completion of the work will provide a technique or equipment which will substantially alter our military capability?
- Is it technically feasible to integrate the new technique or equipment with existing systems?

In other words, the prospective contractor, who investigates the military aspects of a new concept, can often decide for himself whether or not the idea is worth the expense of a formal proposal. Since the military specialist who processes the proposal follows somewhat the same procedure, he is at once impressed with a proposal which shows signs of having been prepared as the result of such an analysis.

Many applied research proposals are technically complicated, and they extend the state of the art to such degree that final answers are available only after meticulous investigation. On the other hand, a first look at some proposals immediately raises some questions which a prospective contractor should have been able to answer by a review of existing knowledge or a simple experiment. Such information voids in a proposal are definitely a handicap to acceptance. It is not contended that the prospective contractor should undertake a research program before he submits a proposal but it is definitely to his advantage to provide enough technical information so the reviewer can reject only on the basis of what is presented.

One item of the formal proposal which should be handled with care is the costs involved. With decreasing military budgets, good technical proposals must be realisticly priced or they are of no use to either the prospective contractor or the military.

The successful contractor in the applied research and exploratory development area is the one capable of producing new or novel military applications of research and technical information, and processing the complete technical investigation at a reasonable cost.

DEFENSE PROCUREMENT

Contracts of $1,000,000 and over awarded during the month of August 1968.

DEFENSE SUPPLY AGENCY

1—**E. I. Dupont DeNemours & Co.,** Wilmington, Del. $2,683,018. 55,708,000 lbs. of ammonium nitrate. Defense General Supply Center, Richmond, Va. DSA 400-69-C-0568.

—**Eastman Kodak Co.,** Rochester, N.Y. $1,135,660. 20,000 rolls of photographic aerial film. Defense General Supply Center, Richmond, Va. DSA 400-69-C-0567.

2—**Stauffer Chemical Co.,** New York, N.Y. $3,202,056. 97,625 gallons of aircraft engine lubricating oil and 2,717,500 quarts of lubricating oil. Defense Fuel Supply Center, Alexandria, Va. DSA 600-68-C-0283.

5—**Delta Petroleum Co.,** New Orleans, La. $1,017,573. 2,367,492 gallons of lubricating oil. Defense Fuel Supply Center, Alexandria, Va. DSA 640-68-D-017.

6—**Sportwelt Shoe Co., Nashua, N.H.** $2,985,445. 480,000 pairs of combat boots. Defense Personnel Support Center, Philadelphia, Pa. DSA 100-69-C-0206.

—**Uniroyal, Inc.,** Providence, R.I. $1,915,625. 3,250 collapsible 500-gallon drums and 1,325 collapsible drums without hardware. Defense General Supply Center, Richmond, Va. DSA 400-69-C-0657.

—**Reynolds Metal Co.,** Richmond, Va. $1,138,320. 3,672,000 lbs. of aluminum powder. Defense General Supply Center, Richmond, Va. DSA 400-69-C-0670.

—**Aluminum Co. of America,** Pittsburgh, Pa. $3,840,870. 12,430,000 lbs. of aluminum powder. Defense General Supply Center, Richmond, Va. DSA 400-68-C-0674.

—**Alcan Metal Powders,** Elizabeth, N.J. $4,206,050. 14,100,000 lbs. of aluminum powder. Defense General Supply Center, Richmond, Va. DSA 400-69-C-0673.

9—**Shell Oil Co.,** New York, N.Y. $1,558,463. 1,332,020 quarts of aircraft engine lubricating oil. Defense Fuel Supply Center, Alexandria, Va. DSA 600-69-C-0284.

13—**Sportwelt Shoe Co., Nashua, N.H.** $1,358,730. 200,000 pairs of men's black oxford shoes. Defense Personnel Support Center, Philadelphia, Pa. DSA 100-69-C-0253.

—**Endicott Johnson Corp.,** Endicott, N.Y. $1,235,025. 184,000 pairs of men's black oxford shoes. Defense Personnel Support Center, Philadelphia, Pa. DSA 100-69-C-0252.

—**International Shoe Co.,** St. Louis, Mo. $1,002,236. 150,000 pairs of men's black oxford shoes. Defense Personnel Support Center, Philadelphia, Pa. DSA 100-69-C-0251.

14—**Eastman Kodak Co.,** Rochester, N.Y. $1,468,147. 1,625 cases of photo chemical kits; 76,500 rolls of aerial photo film and 33,000 rolls of photo film. Defense General Supply Center, Richmond, Va. DSA 400-69-C-0795.

15—**Dole Co.,** San Jose, Calif. $1,891,747. 303,254 cases of canned pineapple. Defense Personnel Support Center, Philadelphia, Pa. DSA 137-69-C-Z018.

16—**Uniroyal, Inc.,** Providence, R.I. $1,915,625. 3,250 collapsible 500-gallon drums and 1,325 collapsible drums without hardware. Defense General Supply Center, Richmond, Va. DSA 400-69-C-0657.

26—**Statham Garment Corp.,** Evansville, Ind. $1,292,826. 188,580 pairs of men's tropical wool trousers. Defense Personnel Support Center, Philadelphia, Pa. DSA 100-69-C-0295.

27—**L. D. Lawson & Co.,** Long Beach, Calif. $6,353,183. 214,020 cases of ration supplement sundries packs. Defense Personnel Support Center, Philadelphia, Pa. DSA 134-69-C-0150.

28—**Ellis Hosiery Co.,** Philadephia, Pa. $1,252,377. 2,208,000 pairs of men's socks. Defense Personnel Support Center, Philadelphia, Pa. DSA 100-69-C-0321.

—**Cavlier Bag Co.,** Lumberton, N.C. $1,529,997. 6,156,000 polypropylene sandbags and 20,950 acrylic sandbags. Defense General Supply Center, Richmond, Va. DSA 400-69-C-1144.

—**Patchogue Plymouth Co.,** Oakbrook, Ill. $3,945,346. 24,925,000 polypropylene sandbags. Defense General Supply Center, Richmond, Va. DSA 400-69-C-1149.

—**Kane Bag Supply Co.,** Baltimore, Md. $1,675,000. 5,000,000 acrylic sandbags. Defense General Supply Center, Richmond, Va. DSA 400-69-C-1145.

—**Bemis Co.,** Minneapolis, Minn. $4,111,888. 1,400,000 polypropylene sandbags and 12,000,000 acrylic sandbags. Defense General Supply Center, Richmond, Va. DSA 400-69-C-1148.

—**Wertham Bag Co.,** Nashville, Tenn. $1,348,200. 4,200,000 acrylic sandbags. Defense General Supply Center, Richmond, Va. DSA 400-69-C-1146.

—**Consolidated Bag Corp.,** Philadelphia, Pa. $1,870,059. 360,000 polypropylene sandbags and 5,580,000 acrylic sandbags. Defense General Supply Center, Richmond, Va. DSA 400-69-C-1139.

30—**Atlantic Richfield Co.,** Los Angeles, Calif. $5,365,038. 33,600,000 gallons of grade 115/145 aviation gasoline. Defense Fuel Supply Center, Alexandria, Va. DSA 600-69-D-0311.

—**Cities Service Oil Co.,** New York, N.Y. $3,916,189. 29,400,000 gallons of grade 115/145 aviation gasoline. Defense Fuel Supply Center, Alexandria, Va. DSA 600-69-D-0313.

—**Gulf Oil Corp.,** New York, N.Y. $3,307,395. 23,913,000 gallons of grade 115/145 aviation gasoline. Defense Fuel Supply Center, Alexandria, Va. DSA 600-69-D-0315.

—**Humble Oil & Refining Co.,** Houston, Tex. $9,281,755. 64,713,800 gallons of grade 115/145 aviation gasoline. Defense Fuel Supply Center, Alexandria, Va. DSA 600-69-D-0317.

—**Mobil Oil Corp.,** New York, N.Y. $13,247,716. 92,500,000 gallons of grade 115/145 and 2,442,000 gallons of grade 80/87 aviation gasoline. Defense Fuel Supply Center, Alexandria, Va. DSA 600-69-D-0318.

—**Philips Petroleum Co.,** Bartlesville, Okla. $10,709,233. 71,178,270 gallons of grade 115/145 and 65,000 gallons of grade 100/130 aviation gasoline. Defense Fuel Supply Center, Alexandria, Va. DSA 600-69-D-0319.

—**Shell Oil Co.** $1,537,035. 9,092,970 gallons of grade 115/145 and 800,000 gallons of grade 100/130 aviation gasoline. Defense Fuel Supply Center, Alexandria, Va. DSA 600-69-D-0320.

—**Union Oil Co.,** Los Angeles, Calif. $3,224,484. 21,588,000 gallons of grade 115/145 and 10,000 gallons of grade 80/87 aviation gasoline. Defense Fuel Supply Center, Alexandria, Va. DSA 600-69-D-0323.

—**Standard Oil Co.,** Louisville, Ky. $2,316,701. 16,861,000 gallons of grade 115/145 aviation gasoline. Defense Fuel Supply Center, Alexandria, Va. DSA 600-69-D-0321.

CONTRACT LEGEND

Contract information is listed in the following sequence: Date—Company — Value — Material or Work to be Performed—Location of Work Performed (if other than company plant) — Contracting Agency—Contract Number.

DEPARTMENT OF THE ARMY

1—**Lockheed Aircraft,** Burbank, Calif. $88,850,000. AH-56A aero vehicles and associated equipment. Van Nuys, Calif. and Johnson City, N.Y. Aviation Materiel Command, St. Louis, Mo. DA AJ01-68-C-1749.

—**Kaiser Jeep Corp.,** Toledo, Ohio. $19,118,777. M39 five-ton trucks. South Bend, Ind. General Purpose Vehicle Project Manager, Warren, Mich. DA AE06-68-C-0012.

—**Sovereign Construction Co.,** Fort Lee, N.J. $15,291,200. Construction of an academic science building, alterations to Thayer Hall, and relocation of Thayer Road at West Point. Engineer Dist., New York, N.Y. DA CA51-69-C-0009.

—**Magnavox Co.,** Fort Wayne, Ind. $7,907,034. AN/GRC-106 radio sets. Electronics Command, Philadelphia, Pa. DA AB05-67-C-0166.

—**Mack Trucks,** Allentown, Pa. $7,057,160. Five-ton truck diesel engines. General Purpose Vehicle Project Manager, Warren, Mich. DA AE06-68-C-0010.

—**E. I. Dupont de Nemours & Co.,** Wilmington, Del. $1,724,250. TNT. Barksdale, Wis. Ammunition Procurement & Supply Agency, Joliet, Ill. DA 11-173-AMC-00985 (A).

—**Bell Aerospace Corp.,** Fort Worth, Tex. $1,287,218. UH-1 aircraft main rotor hubs. Hurst, Tex. Aviation Materiel Command, St. Louis, Mo. DA AJ01-68-A-0022.

2—**Temco, Inc.,** Nashville, Tenn. $2,740,077. Metal parts for XM314A2E1 projectiles. Ammunition Procurement & Supply Agency, Joliet, Ill. DA AA09-68-C-0206.

—**Global-Fischbach,** Oakland, Calif. $1,557,243. Construction of an impact instruction tower; a range control center; and an airmen's dormitory at Eniewetok. Engineer Dist., Honolulu, Hawaii. DA CA83-69-C-0002.

—**Chamberlain Mfg. Corp.,** New Bedford, Mass. $1,516,032. Metal parts for 155mm projectiles. Ammunition Procurement & Supply Agency, Joliet, Ill. DA AA09-68-C-0325.

—**General Motors,** Detroit, Mich. $1,354,376. Main battle tank design. Warren, Mich. and Cleveland, Ohio. Tank Automotive Command, Warren, Mich. DA 20-113-AMC-08843.

—**Robert E. McKee,** El Paso, Tex. $1,081,152. Construction of administrative and storage buildings, a heating plant, and for extension of utilities, roads and walks, at Fort Carson, Colo. Engineer Dist., Omaha, Neb. DA CA45-68-C-0081.

5—**Bell Aerospace Corp.,** Fort Worth, Tex. $1,700,385. Rotary wing blades for UH-1 helicopters. Hurst, Tex.; $60,767,550. UH-1H helicopters. Hurst, Tex. Aviation Materiel Command, St. Louis, Mo. DA AJ01-68-A-0022. DA AJ01-69-C-0028.

—**Essential Construction Co.** and **Himount Constructors,** Fort Lee, N.J. $6,387,500. Construction of 200 housing units at the U.S. Military Academy, West Point, N.Y. Engineer Dist., New York, N.Y. DA CA51-69-C-0013.

—G. W. Galloway, Baldwin Park, Calif. $1,604,740. Containers for the Shillelagh missile. Army Missile Command, Huntsville, Ala. DA AH01-68-C-2037.

—**Texas Instruments,** Dallas, Tex. $3,-

250,000. Night vision aerial surveillance systems. Mobility Equipment Research & Development Center, Fort Belvoir, Va. DA AK02-68-C-0308.

6—**Bell Helicopter Co.**, Fort Worth, Tex. $2,076,740. Tail boom assemblies for UH-1 helicopters. Hurst, Tex. Aviation Materiel Command, St. Louis, Mo. DA AJ01-68-A-0022.

—**Rulon Co.**, Chicago, Ill. $4,645,125. Metal parts for M1 delay plungers for M557 fuzes. Ammunition Procurement & Supply Agency, Joliet, Ill. DA AA09-68-C-0387.

—**A. O. Smith Corp.**, Chicago, Ill. $1,671,929. Metal parts for 750-lb. demolition bombs. Bellmead, Tex. Ammunition Procurement & Supply Agency, Joliet, Ill. DA AA09-68-C-0078.

—**General Electric**, West Lynn, Mass. $9,259,073. Engines for AH-56A aero vehicles (combination rotary/fixed-wing aircraft). Aviation Materiel Command, St. Louis, Mo. DA AJ01-69-C-0073.

8—**Arkansas State Highway Commission**, Little Rock, Ark. $8,483,000. Work on the Arkansas River navigation project. Engineer Dist., Little Rock, Ark. DA CW03-69-C-0008.

9—**Pace Corp.**, Memphis, Tenn. $2,612,540. Surface trip flares. Camden, Ark. Picatinny Arsenal, Dover, N.J. DA AA21-68-C-0497.

—**Chamberlain Mfg. Co.**, New Bedford, Mass. $2,500,000. Acquisition of production equipment, rehabilitation, plant rearrangement, installation and freight for the production of metal parts for 155mm shells. Ammunition Procurement & Supply Agency, Joliet, Ill. DA 19-020-ORD-5459 (A).

—**Hughes Tool Co.**, Culver City, Calif. $1,947,096. Crew armor and component kits for OH-6A helicopters. Aviation Materiel Command, St. Louis, Mo. DA 23-204-AMC-03697.

—**Varo, Inc.**, Garland, Tex. $7,908,000. Image intensifier assemblies for the starlight scope night vision program. Electronics Command, Fort Monmouth, N.J. DA AB07-68-C-0116.

—**United Aircraft**, Stratford, Conn. $2,500,000. CH-54A helicopters. Aviation Materiel Command, St. Louis, Mo. DA AJ01-68-C-0827.

12—**Guy H. James Construction Co.**, Oklahoma City, Okla. $8,189,108. Construction of a gravity type concrete spillway at Hugo Reservoir, Okla. Engineer Dist., Tulsa, Okla. DA CW56-69-C-0005.

—**American Fabricated Products Co.**, Indianapolis, Ind. $1,712,689. 81mm mortar fin assemblies. Ammunition Procurement & Supply Agency, Joliet, Ill. DA AA09-68-C-0298.

—**Diamond Construction Co.**, Savannah, Ga. $1,091,630. Channel improvement on the Cape Fear River near Wilmington, N.C. Engineer Dist., Wilmington, N.C. DA CW54-69-C-0002.

14—**Computing & Software, Inc.**, El Paso, Tex. $1,734,990. Non-personal services for data reduction, computer programing and related maintenance services at Holloman AFB, N.M. White Sands Missile Range, N.M. DA AD07-69-C-0006.

—**Aerojet General**, Downey, Calif. $1,250,000. Bomb dispensers. Ammunition Procurement & Supply Agency, Joliet, Ill. DA AA09-69-C-0025.

—**Fred A. Arnold, Inc.**, Los Angeles, Calif. $1,036,853. Construction of a concrete addition to an existing building for reentry assembly, surveillance and inspection at Vandenberg AFB, Calif. Engineer Dist., Los Angeles, Calif. DA CA09-69-C-0024.

—**Levinson Steel Co.**, Pittsburgh, Pa. $14,509,066. Metal parts for 105mm projectiles. Ammunition Procurement & Supply Agency, Joliet, Ill. DA AA09-69-C-0023.

15—**ITT**, Easton, Pa. $7,878,000. Image intensifier assembly, 25mm. Roanoke, Va. Electronics Command, Fort Monmouth, N.J. DA AB07-68-C-0115.

—**Litton Systems**, Van Nuys, Calif. $5,120,352. Data converter, coordinated air defense systems. Salt Lake City, Utah and Van Nuys, Calif. Army Missile Command, Huntsville, Ala. DA AH01-67-C-1988.

—**Philco-Ford Corp.**, Newport Beach, Calif. $4,360,625. Guidance and control equipment for Shillelagh guided missiles. Army Missile Command, Huntsville, Ala. DA AH01-67-C-0002.

—**Honeywell, Inc.**, Hopkins, Minn. $1,283,131. Special assembly machines to meet requirements for the M551 and M533 fuze for artillery shells. Ammunition Procurement & Supply Agency, Joliet, Ill. DA 11-022-ORD-2895.

—**Teledyne Systems**, Northridge, Calif. $8,000,000. Central computer complex components and associated equipment for use in Cheyenne AH-56A helicopters. Army Electronics Command, Fort Monmouth, N.J. DA AB07-68-C-0255.

—**Union Carbide Corp.**, New York, N.Y. $1,239,504. Dry batteries and ancillary items. Cleveland, Ohio. Electronics Command, Philadelphia, Pa. DA AB05-69-C-3024.

16—**Sperry Rand Corp.**, New York, N.Y. $43,977,106. Manufacture of major caliber ammunition items and components. Ammunition Procurement & Supply Agency, Joliet, Ill. DA 11-173-AMC-00080 (A).

—**General Electric**, Portland, Ore. $10,849,000. Generators. Engineer Dist., Portland, Ore. DA CW57-69-C-0023.

—**Peter Kiewit Sons Co.**, Vancouver, Wash. $4,596,364. Grading and embankment protection work for the Lower Granite Lock and Dam. Lewiston, Idaho. Engineer Dist., Walla Walla, Wash. DA CW68-69-C-0019.

—**AVCO Corp.**, Stratford, Conn. $2,793,986. Turbine rotor blades. Aviation Materiel Command, St. Louis, Mo. AF-41-608-67-A-3634.

—**Continental Motors**, Moblie, Ala. $1,289,431. Remanufacture and retrofit of A01895-3 engines to AOSI805-5 configuration for the M42 vehicle. Tank Automotive Command, Warren, Mich. DA AE07-67-C-4960.

19—**Hamilton Watch Co.**, Lancaster, Pa. $2,800,000. 650,000 rear fitting and safety devices for the artillery proximity fuze. Harry Diamond Laboratories, Washington, D.C. DA AG39-68-C-0039.

20—**Atlas Chemical Industries**, Wilmington, Del. $12,949,541. Production of TNT. Chattanooga, Tenn. Ammunition Procurement & Supply Agency, Joliet, Ill. DA 11-173-AMC-00531 (A).

—**Donovan Construction Co.**, New Brighton, Minn. $11,264,750. Metal parts for 155mm projectiles. Ammunition Procurement & Supply Agency, Joliet, Ill. DA AA09-69-C-0036.

—**Magnavox Co.**, Urbana, Ill. $4,666,200. M18 gun direction computers. Army Procurement Agency, Chicago, Ill. DA AA25-68-C-0429.

—**Farmer's Chemical Corp.**, Tyner, Tenn. $2,861,700. Production of mixed acids. Ammunition Procurement & Supply Agency, Joliet, Ill. DA 11-173-AMC-00300 (A).

21—**American Machine & Foundry Co.**, Brooklyn, N.Y. $30,253,380. Metal parts for 750-lb. bombs. Ammunition Procurement & Supply Agency, Joliet, Ill. DA AA09-69-C-0035.

—**General Motors**, Detroit, Mich. $9,791,040. 81mm cartridge projectiles. Warren and Saginaw, Mich. Ammunition Procurement & Supply Agency, Joliet, Ill. DA AA09-68-C-0281.

—**Bell Helicopter**, Fort Worth, Tex. $5,700,000. Maintenance repair parts and special support equipment for the OH-58A helicopter. Hurst, Tex. Aviation Materiel Command, St. Louis, Mo. DA AJ01-68-A-0118.

—**Goodyear Tire & Rubber Co.**, Akron, Ohio. $4,954,860. Rubber track shoe assembly for the M60 tank. St. Mary's, Ohio. Tank Automotive Command, Warren, Mich. DA AE07-69-C-0087.

—**Nortronics**, Needham Heights, Mass. $1,838,592. 81mm mortar fin assemblies. Ammunition Procurement & Supply Agency, Joliet, Ill. DA AA09-68-C-0251.

—**Main Cornice Works, Inc.**, Beverly Hills, Calif. $1,626,960. Construction of 90 family housing units at the Naval Postgraduate School, Monterey, Calif. Engineer Dist., Sacramento, Calif.

22—**Honeywell, Inc.**, Hopkins, Minn. $3,238,498. Facilities to meet current requirements for artillery projectile fuzes. New Brighton, Minn. Ammunition Procurement & Supply Agency, Joliet, Ill. DA 11-022-ORD-2895.

23—**Olin Mathieson Chemical Corp.**, New York, N.Y. $116,787,500. Production of propellants and ammunition components. Charleston, Ind. Ammunition Procurement & Supply Agency, Joliet, Ill. DA 11-173-AMC-00097 (A).

—**Campbell Co.**, Tyler, Tex. $10,825,000. Construction of a 435-bed hospital. Fort Jackson, S.C. Engineer Dist., Savannah, Ga. DA CA69-69-C-0007.

—**Whirlpool Corp.**, Evansville, Ind. $3,487,806. 105mm anti-personnel projectiles. DA AA21-69-C-0098; $1,360,868. Metal parts for 152mm canisters. DA AA21-69-C-0094; $1,643,008. 105mm projectiles. DA AA21-69-C-0092; $3,801,924. 90mm projectiles. DA AA21-69-C 0090. Picatinny Arsenal, Dover, N.J.

—**Bulova Watch Co.**, Providence, R.I. $2,484,600. Head assemblies for fuzes for 60mm mortar projectiles. Ammunition Procurement & Supply Agency, Joliet, Ill. DA AA09-68-C-0077.

—**Fairchild Space & Defense Systems**, Copiague, N.Y. $3,092,800. Fuzes for 2.75-inch rockets. Ammunition Procurement & Supply Agency, Joliet, Ill. DA AA09-69-C-0032.

—**La Pointe Industries**, Tolland, Conn. $1,897,570. Fixed-base mounted antennae. Electronics Command, Philadelphia, Pa. DA AB05-68-C-0009.

26—**National Gypsum Co.**, Buffalo, N.Y. $30,827,000. Production of 105mm ammunition items. Ammunition Procurement & Supply Agency, Joliet, Ill. DA 11-173-AMC-00095 (A).

—**Atlantic & Gulf Stevedores**, Baltimore, Md. $7,242,544. Stevedoring and related terminal services, for period Sept. 3, 1968 through Sept. 2, 1970. Eastern Area, Military Traffic Management & Terminal Service, Brooklyn, N.Y. DA HC21-69-D-0063.

—**URS Corp.**, San Mateo, Calif. $5,513,005. Advancement of design, development of design, programming and testing of prototype software for the Combat Service Support System. Mobility Equipment Command, Fort Belvoir, Va. DA 02-086-AMC-00539 (Y).

—**Zenith Radio Corp.**, Chicago, Ill. $2,680,804. Light anti-tank rocket fuzes. Ammunition Procurement & Supply Agency, Joliet, Ill. DA AA09-69-C-0039.

27—**Hensel Phelps Construction Co.**, Greeley, Colo. $1,558,000. Construction of a rifle squad tactical range at Fort Riley, Kan. Engineer Dist., Kansas City, Mo. DA CA41-69-C-0017.

—**Main Cornice Work**, Beverly Hills, Calif. $1,655,566. Construction of Navy enlisted men's family housing at Fort Ord, Calif. Engineer Dist., Sacramento, Calif. DA CA05-69-C-0009.

—**Day & Zimmermann**, Philadelphia, Pa. $12,132,370. Loading, assembling and packing of miscellaneous ammunition items and components. Texarkana, Tex. Ammunition Procurement & Supply Agency, Joliet, Ill. DA 11-173-AMC-00114 (A).

—**Zenith Radio Corp.**, Chicago, Ill. $2,977,849. 2.75-inch rocket fuzes. Ammunition Procurement & Supply Agency, Joliet, Ill. DA AA09-69-C-0033.

—**Holston Defense Corp.**, Kingsport, Tenn. $2,407,155. Production of explosives and for support services. Ammunition Procurement & Supply Agency, Joliet, Ill. DA 11-173-AMC-00035 (A).

—**Amron**, Orlando, Fla. $1,753,550. Special assembly machines for manufacturing M551 metal fuze parts. Ammunition Procurement & Supply Agency, Joliet, Ill. DA AA09-69-C-0045.

—**Northrop Corp.**, Anaheim, Calif. $3,037,048. 90mm projectiles. DA AA21-69-C-0091; $1,643,009. 105mm projectiles. DA AA21-69-C-0093; $1,121,917. 152-mm canisters. DA AA21-69-C-0095; $2,530,836. 105mm projectile metal parts. Picatinny Arsenal, Dover, N.J.

28—**Glover, Ltd.**, Honolulu, Hawaii. $1,595,000. Channel work and construction of a bridge at Kuliouou Stream, Oahu, Hawaii. Engineer Dist., Honolulu, Hawaii. DA CW83-69-C-0007.

—**Hercules, Inc.**, Wilmington, Del. $31,585,496. Manufacture of propellants and explosives, and for support services. Radford, Va. Ammunition Procurement & Supply Agency, Joliet, Ill. W-11-173-AMC-00037 (A).

—**R. G. LeTourneau, Inc.**, Longview, Tex. $24,039,720. 750-lb. bomb metal parts. Longview and Arlington, Tex. Ammunition Procurement & Supply Agency, Joliet, Ill. DA AA09-69-C-0044.

—**Uniroyal, Inc.**, New York, N.Y. $9,842,637. Manufacture of explosives, lading, assembling and packing ammunition and for support services. Joliet, Ill. Ammuni-

tion Procurement & Supply Agency, Joliet, Ill. DA–11–173–AMC–00062 (A).

—**Stewart Warner Corp.**, Lebanon, Ill. $2,020,884. Metal parts for 60mm projectiles. Ammunition Procurement & Supply Agency, Joliet, Ill. DA AA09–69–C–0040.

—**Grand Machining Co.**, Detroit, Mich. $1,480,777. Fin assemblies for 81mm mortars. Vero Beach, Fla. Ammunition Procurement & Supply Agency, Joliet, Ill. DA AA09–68–C–0039.

29—**Lee Construction Co.**, Bartlesville, Okla. $4,532,705. Replacement of St. Louis-San Francisco railroad bridge crossing the Verdigris River near Catoosa, Okla. Engineer Dist., Tulsa, Okla. DA CW56–69–C–0013.

—**Cummins Engine Co.**, Columbus, Ind. $1,917,269. 446 engines (V8–300) for the M123A1C ten-ton truck. Tank Automotive Command, Warren, Mich. DA AE07–67–C–5022.

—**Continental Motors**, Muskegon, Mich. $2,863,014. Military standard gas engines. Milwaukee, Wis. Mobility Equipment Command, St. Louis, Mo. DA 23–195–AMC–00808 (T).

—**KDI Precision Productions**, Cincinnati, Ohio. $1,596,540. 451,000 safety and arming devices for fuzes used on the 2.75-inch air-to-ground rocket. Army Procurement Agency, Cincinnati, Ohio. DA AG31–69–C–0071.

—**Colt's, Inc.**, Hartford, Conn. $3,066,-624. 4,906,628 20-round magazine assemblies for the M16 weapons family. Army Weapons Command, Rock Island, Ill. DA AF03–69–C–0007.

30—**Pacific Technical Analysts**, Honolulu, Hawaii. $2,091,172. Classified work. Army Missile Command, Huntsville, Ala. DA AH01–68–C–1602.

—**Chamberlain Mfg. Corp.**, Elmhurst, Ill. $1,834,587. Metal parts for 4.2-inch illuminating projectiles. Waterloo, Iowa, Ammunition Procurement & Supply Agency, Joliet, Ill. DA AA09–68–C–0036.

—**Ham'lton Watch Corp.**, Lancaster, Pa. $5,775,000. 300,000 mechanical time fuzes for 105mm and 4.2-inch mortar illuminating shells. East Petersburg, Pa. Ammunition Procurement & Supply Agency, Joliet, Ill. DA AA09–68–C–0503.

—**Honeywell, Inc.**, Hopkins, Minn. $5,170,-620. Metal parts for point detonating fuzes for the 40mm cartridge. New Brighton, Minn. Ammunition Procurement & Supply Agency, Joliet, Ill. DA AA09–69–C–0041.

—**Amron Corp.**, Orlando, Fla. $4,553,888. Metal parts for point detonating fuzes for the 40mm cartridge. Ammunition Procurement & Supply Agency, Joliet, Ill. DA AA09–69–C–0047.

—**Honeywell, Inc.**, Hopkins, Minn. $6,932-100. Metal parts for point detonating fuzes for the 40mm cartridge. Ammunition Procurement & Supply Agency, Joliet, Ill. DA AA09–69–C–0046.

—**Bell & Howell Co.**, Chicago, Ill. $2,707,-740. Metal parts for fuzes for the 81mm illuminating projectiles. Evanston, Ill. Ammunition Procurement & Supply Agency, Joliet, Ill. DA AA09–69–C–0055.

—**Olin Mathieson Chemical Corp.**, East Alton, Il. $2,863,474. Assembly loaded illuminating projectiles. Marion, Ill. Ammunition Procurement & Supply Agency, Joliet, Ill. DA AA09–69–C–0051.

—**Cerro Copper & Brass Co.**, Bellefonte, Pa. $2,138,250. Metal parts for time train rings for fuzes used on mortar rounds. Ammunition Procurement & Supply Agency, Joliet, Ill. DA AA09–69–C–0065.

—**General Time Corp.**, Stamford, Conn. $6,891,091. 362,880 mechanical time super quick fuzes used on artillery and mortar shells. Thomaston, Conn. Ammunition Procurement & Supply Agency, Joliet, Ill. DA AA09–68–C–0229.

—**National Presto Industries**, Eau Claire, Wis. $46,800,000. Metal parts for 105mm high explosive projectiles. Ammunition Procurement & Supply Agency, Joliet, Ill. DA AA09–69–C–0028.

—**Kilgore Corp.**, Toone, Tenn. $1,835,150. Pyrotechnics. Picatinny Arsenal, Dover, N.J. DA AA21–69–C–0116.

—**Pine Bluff Arsenal**, Pine Bluff, Ark. $1,530,000. 105mm smoke projectiles. Edgewood Arsenal, Edgewood, Md.

—**John Wood Co.**, St. Paul, Minn. $1,137,-766. 750-lb. bomb fin assemblies. Ammunition Procurement & Supply Agency, Joliet Ill. DA AA09–68–C–0484.

—**R. G. LeTourneau, Inc.**, Longview, Tex. $4,863,600. 750-lb. bomb fin assemblies. Ammunition Procurement & Supply Agency, Joliet, Ill. DA AA09–69–C–0058.

—**Crecent Precision Products**, Garland, Tex. $3,619,980. 750-lb. bomb fin assemblies. Ammunition Procurement & Supply Agency, Joliet, Ill. DA AA09–69–C–0059.

—**AVCO Corp.**, Stratford, Conn. $29,053,-961. 1,033 gas turbine engines for use on the UH and Cobra helicopters. Aviation Materiel Command, St. Louis, Mo. DA AJ01–68–C–1874.

—**Hercules Engines**, Canton, Ohio. $3,934,-803. Gasoline operated military standard engines. Mobility Equipment Command, St. Louis, Mo. DA 23–195–AMC–00284 (T).

—**Construction, Ltd.**, Bordentown, N.J. $1,335,052. Construction of two BOQ buildings. Engineer Dist., New York, N.Y. DA CA51–69–C–0025.

—**Union Carbide Corp.**, New York, N.Y. $1,-953,528. 552,000 radio set dry batteries. Charlotte, N.C. Electronics Command, Philadelphia, Pa. DA AB05–69–C–3084.

—**Raytheon Co.**, Andover, Mass. $6,776,-303. Factory test equipment and quality control gauging for the improved Hawk system. Army Missile Command, Huntsville, Ala. DA AH01–67–C–A028.

—**Raytheon Co.**, Andover, Mass. $14,836,-909. Engineering services for the improved Hawk missile system. Army Missile Command, Huntsville, Ala. DA AH01–69–C–0099.

DEPARTMENT OF THE NAVY

1—**Westinghouse Electric**, West Mifflin Borough, Pa. $15,445,000. Nuclear propulsion research and development. Naval Ship Systems Command. N00024–67–C–5015.

—**North American Rockwell Corp.**, Anaheim, Calif. $4,626,604. Modernization and repair of MK II ships inertial navigation systems. Naval Ship Systems Command. N00024–69–C–5054.

—**Sperry Rand Corp.**, Syosset, N.Y. $1,-439,725. Modernization and overhaul of the navigation subsystems for three fleet ballistic missile submarines. Naval Ship Systems Command. N00024–69–C–5307.

2—**Borg Warner Corp.**, Chicago, Ill. $15,-914,464. 500-lb. bomb bodies. Navy Ships Parts Control Center, Mechanicsburg, Pa. N00104–69–C–0003.

—**Philco Ford Corp.**, Menlo Park, Calif. $3,609,947. Telemetry receive/record systems and mobile general-purpose telemetry systems. Navy Purchasing Office, Los Angeles, Calif. N00123–65–C–1333.

—**Continental Electronics Mfg. Co.**, Waltham, Mass. $3,000,338. Submarine antenna systems. Naval Ship Systems Command. N00024–69–C–1016.

—**Curtiss Wright Corp.**, Wood-Ridge, N.J. $1,879,254. R1820 aircraft engine spare parts. Aviation Supply Office, Philadelphia, Pa. F41608–67–A–5900–GB–JP.

—**Sanders Associates**, Nashua, N.H. $1,779,-557. Basic engineering and development of an air droppable ASW sonobuoy system. Naval Air Systems Command. N00019–67–C–0039.

—**Washington Iron Works**, Seattle, Wash. $1,084,800. Procurement and installation of portal cranes for Wharf Alpha at the Naval Weapons Station, Charleston, S.C. Midwest Div., Naval Facilities Engineering Command, Great Lakes, Ill. N62465–68–B–0242.

5—**McDonnell Douglas Corp.**, St. Louis, Mo. $19,500,000. Extension of long lead time effort for the FY 1969 F–4 aircraft program. Naval Air Systems Command. N00019–67–C–0171.

—**L&A Contracting Co.**, Hattiesburg, Miss. $2,918,049. Construction of a berthing wharf at the Naval Station, Mayport, Fla. Naval Facilities Engineering Command. NBy 86238.

—**Honeywell, Inc.**, St. Petersburg, Fla. $2,848,549. Inertial components for Poseidon missiles. Special Projects Office. N00030–69–C–0085.

—**Curtiss Wright Corp.**, Wood-Ridge, N.J. $2,037,474. Spare parts for R1820 engines. Aviation Supply Office, Philadelphia, Pa. F41608–67–A–59000–GBJQ.

6—**Norris Industries**, Los Angeles, Calif. $8,912,557. MK 82, MOD 1, bomb bodies for 500-lb. bombs. Navy Ships Parts Control Center, Mechanicsburg, Pa. N00124–67–C–2685–MOD 24.

—**Grumman Aircraft Engineering Corp.**, Bethpage, N.Y. $8,400,000. Long lead time effort for the FY 1969 A–6A program. Naval Air Systems Command. NOw 66–0058.

—**Symetrics Engineering Corp.**, Satellite Beach, Fla. $1,393,500. Five receiving antenna systems for use aboard EC–121K telemetry aircraft. Navy Purchasing Office, Los Angeles, Calif. N00123–69–C–0272.

—**Franchi Bros. Construction Corp.**, Wellesley Hills, Mass. $1,142,000. Construction of barracks at the Naval Station, Newport, R.I. Naval Facilities Engineering Command. N62464–67–C–0307.

7—**Collins Radio Co.**, Dallas, Tex. $2,019,891. Manufacture of LORAN "C" equipment. Naval Electronic Systems Command. N00039–69–C–2512.

—**General Precision, Inc.**, Little Falls, N.J. $1,820,981. Automatic degaussing systems, cable assemblies and associated items. Naval Ship Systems Command. N00024–69–C–5092.

—**Graham Contracting Co.**, Orlando, Fla. $1,059,000. Construction of a gym, field house, theatre and an outdoor training pool at the Naval Training Center, Orlando, Fla. Southeast Div., Naval Facilities Engineering Command, Charleston, S.C. NBy–84075.

8—**Sanders Associates, Inc.**, Nashua, N.H. $11,874,400. Electronics equipment. Naval Air Systems Command. N00019–68–C–0630.

—**AAI Corp.**, Cockeysville, Md. $3,791,048. MK 48, MOD 0, gun mounts for use on river patrol boats. Naval Ordnance Station, Louisville, Ky. N00197–68–C–0374.

—**FMC Corp.**, Minneapolis, Minn. $2,000,-000. Design and development of 175mm/60 cal. gun mounts. Fridley, Minn. Naval Ordnance Systems Command. NOw–66–0086.

—**Bendix Corp.**, Teterboro, N.J. $2,017,100. Components and spare parts for ASN 66 navigation computer sets for EA–6A and EKA–3B aircraft. Aviation Supply Office, Philadelphia, Pa. N00383–67–A–0501–0529.

—**Sperry Rand Corp.**, Great Neck, N.Y. $1,000,000. Talos guided missile fire control system research and development. Naval Ordnance Systems Command. N00017–67–C–2201.

9—**United Aircraft**, Stratford, Conn. $2,500,-000. CH–53A helicopters. Naval Air Systems Command. N00019–69–C–0070.

13—**Grumman Aircraft Engineering Corp.**, Bethpage, N.Y. $1,000,000. Contract definition phase of the VFX weapon system. Naval Air Systems Command. N00019–69–C–0053.

—**LTV Aerospace Corp.**, Dallas, Tex. $1,-000,000. Contract definition phase of the VFX weapon system. Naval Air Systems Command. N00019–69–C–0052.

—**General Dynamics**, San Diego, Calif. $1,000,000. Contract definition phase of the VFX weapon system. Naval Air Systems Command. N00019–69–C–0047.

—**North American Rockwell Corp.**, El Segundo, Calif. $1,000,000. Contract definition phase of the VFX weapon system. Naval Air Systems Command. N00019–69–C–0048.

—**McDonnell Douglas Corp.**, St. Louis, Mo. $1,000,000. Contract definition phase of the VFX weapon system. Naval Air Systems Command. N00019–69–C–0051.

—**Curtiss Wright Corp.**, Wood-Ridge, N.J. $1,917,217. Kits in support of J65W16A-W20 engines used on A4–A, A4–B and A4–C aircraft. Aviation Supply Office, Philadelphia, Pa. F41608–67–A–5900–GBJR.

—**Raytheon Co.**, Lexington, Mass. $10,447,-142. Production of firing mechanisms. Naval Ordnance Systems Command. N00017–69–C–1403.

14—**General Electric,** West Lynn, Mass. $3,-200,549. Spare parts for T64-GE12 engines used on CH-53A helicopters. Aviation Supply Office, Philadelphia, Pa. F34601-68-A-211-GBCX.

15—**Sanders Associates,** Nashua, N.H. $1,-379,184. Research and development on classified electronic equipment. Naval Air Systems Command. N00019-68-C-0621.

—**General Electric,** West Lynn, Mass. $3,-022,492. Spare parts for T64-GE12 engines. Aviation Supply Office, Philadelphia, Pa. F34601-68-A-2114-GBDD.

—**Teledyne Systems Co.,** Hawthorne, Calif. $3,967,105. Self contained navigation systems. Naval Air Systems Command. N00019-67-C-0189.

16—**Grumman Aircraft Engineering Corp.,** Bethpage, N.Y. $17,900,000. Incremental funding for the EA-6B program. Naval Air Systems Command. N00019-67-C-0078.

—**General Precision Systems,** Glendale, Calif. $6,743,188. Production of fire control systems MK 113, MOD 8, and associated equipment. Naval Ordnance Systems Command. N00017-68-C-1220.

—**Corbetta Construction Co.,** Des Plaines, Ill. $5,955,000. Construction of service school barracks at the Naval Training Center, Great Lakes, Ill. Midwest Div., Naval Facilities Engineering Command, Great Lakes, Ill. N62465-69-C-0006.

—**Hughes Aircraft,** Culver City, Calif. $5,800,000. Phoenix guided missiles. Naval Air Systems Command. N00019-C-0295.

—**United Aircraft,** Windsor Locks, Conn. $1,900,000. Propeller systems for the C-130 aircraft. Aviation Supply Office, Philadelphia, Pa. N00383-67-A-1901-0677.

—**Standard Products Co.,** Cleveland, Ohio. $1,107,957. Shedder seal track section kits for the repair and overhaul of amphibious vehicles. Headquarters, Marine Corps. M00150-69-C-0109.

19—**Marinette Marine Corp.,** Marinette, Wis. $4,084,600. Construction of 26 aluminum landing craft, mechanized (LCM). Naval Ship Systems Command. N00024-69-C-0217.

—**General Dynamics,** Groton, Conn. $1,-752,921. Nuclear powered attack submarine concept-formulation studies in the areas of ship design, operations analysis, and systems engineering. Naval Ship Systems Command. N00024-69-C-0347.

20—**Vickers Limited Engineering Group.,** Newcastle Upon Tyne, England. $4,496,-102. Production of ASROC launchers and related equipment. Naval Ordnance Systems Command. N00017-69-C-1406.

21—**General Dynamics,** Quincy, Mass. $3,-946,880. Nuclear propulsion plants. Naval Ship Systems Command. N00024-68-C-5483.

—**Fred A. Arnold, Inc.,** Los Angeles, Calif. $2,263,000. Construction of 118 family housing units at the Naval Postgraduate School, Monterey, Calif. Western Div., Naval Facilities Engineering Command, San Bruno, Calif. N62474-67-B-0768.

—**Sanders Associates,** Nashua, N.H. $1,-319,400. ECM equipment. Naval Air Systems Command. N00019-69-C-0050.

—**M.O.N.T. Boat Rental Services,** Golden Meadow, La. $1,080,000. Six 100-foot commercial type utility boats. Naval Ship Systems Command. N00024-69-C-0218.

22—**North American Rockwell Corp.,** Anaheim, Calif. $5,700,000. Repair of ships inertial navigation systems (SINS) equipment. Naval Ship Systems Command. N00024-69-C-5033.

—**Boland Machine & Mfg. Co.,** New Orleans, La. $5,393,944. Activation, repair and conversion of the Marshfield Victory to a fleet ballistic missile resupply cargo ship. Naval Ship Systems Command.

23—**McDonnel Douglas Corp.,** St. Louis, Mo. $20,500,000. Extension of long lead time effort for the FY 1969 F-4 aircraft program. Naval Air Systems Command. N00019-69-C-0171.

—**Dillingham Construction Corp.,** Benicia, Calif. $2,500,000. Construction of an aircraft hanger at Travis AFB, Calif. Naval Facilities Engineering Command.

26—**American Mfg. Co. of Tex.,** Fort Worth, Tex. $8,525,000. Bomb bodies for 1000-lb. bombs. Navy Ships Parts Control Center, Mechanicsburg, Pa. N00104-69-C-0018.

—**American Cement Corp.,** Los Angeles, Calif. $2,838,560. 94-lb. bags of Portland cement. Crestmore, Calif. Navy Purchasing Office, Los Angeles. Calif. N00123-69-D-0426.

—**Metals Engineering Co.,** Greeneville, Tenn. $1,882,952. Fin assemblies for bombs with suspension lugs and crates. Navy Ships Parts Control Center, Mechanicsburg, Pa. N00104-69-C-0019.

—**J.S. Floyd Corp.,** Norfolk, Va. $1,784,-727. Rehabilitation of barracks at the Naval Air Station, Oceana, Va. Naval Facilities Engineering Command. 62470-68-C-0062.

—**R. D. Lambert & Sons,** Chesapeake, Va. $1,053,000. Construction of an avionics shop at the Naval Air Station, Oceana, Va. Naval Facilities Engineering Command. 62470-68-C-0743.

27—**U.S. Steel,** Pittsburgh, Pa. $10,771,001. 500-lb. bomb bodies. Navy Ships Parts Control Center, Mechanicsburg, Pa. N00104-68-C-3599 P009.

—**Burroughs Corp.,** Paoli, Pa. $6,986,-000. Classified equipment. Naval Ordnance Systems Command. N00017-69-C-1402.

—**Sperry Rand Corp.,** Syosset, N.Y. $4,-250,000. Technical assistance associated with the Fleet Ballistic Missile Submarine USS James Madison (SSBN-627) Class Overhaul Program. Naval Ship Systems Command. N00024-69-C-5119.

—**Kaman Aircraft,** Bloomfield, Conn. $2,-110,348. Modification of UH-2A/B helicopters to a twin engine configuration designated UH-2C. Naval Air Systems Command. N00019-69-C-0066.

—**General Electric,** West Lynn, Mass. $22,300,000. Engineering development of the TF-34 turbofan engine for VSX aircraft. Naval Air Systems Command. N00019-68-C-0443.

—**Lockheed Aircraft,** Burbank, Calif. $5,-400,000. Contract definition for the VSX weapon system. Naval Air Systems Command. N00019-69-C-0102.

—**General Dynamics,** San Diego, Calif. $4,885,000. Contract definition for the VSX weapon system. Naval Air Systems Command N00019-69-C-0055.

28—**Kollsman Instrument Corp.,** Syosset, N.Y. $2,983,004. Reproduction of technical data for rangefinding, telescopic and other related equipment. Naval Ordnance Systems Command. N00017-69-C-4203.

—**General Precision, Inc.,** Wayne, N.J. $2,000,000. Advanced guidance system work on Poseidon. Strategic Systems Project Office. N00030-69-C-0086.

—**Westinghouse Electric,** Pittsburgh, Pa. $38,580,000. Nuclear reactor components. Naval Ship Systems Command. N00024-69-C-5101.

29—**General Dynamics,** Groton, Conn. $3,-000,000. Advance planning, design, and other work preparatory to the conversion of the Fleet Ballistic Missile submarines USS Casimir Pulaski (SSBN-633) and USS Stonewall Jackson (SSBN-634) to C-3 Poseidon missile capability. Naval Ship Systems Command. N00024-69-C-0214.

—**General Electric,** Syracuse, N.Y. $1,-781,278. Field change kits for AN/SPS-30 radar sets. Naval Supply Center, Norfolk, Va. N00189-69-C-0021.

—**United Aircraft,** East Hartford, Conn. $1,770,392. Engine spare parts to support J48 and J57 engines for F-9F aircraft. Aviation Supply Office, Philadelphia, Pa. N00383-9-69-000A-AF633.

—**Campbell Machine, Inc.,** San Diego, Calif. $1,269,396. Construction of two 85-foot light warping tugs. Naval Ship Systems Command. N00024-69-C-0219.

—**United Aircraft,** East Hartford, Conn. $1,233,799. Engine spare parts to support J52 and J57 engines for F8, A3, A4 and A6 aircraft. Aviation Supply Office, Philadelphia, Pa. N00383-9-69-000A-AF632.

—**Sperry Gyroscope Co.,** Great Neck, N.Y. $1,400,000. Modernization of the Terrier MK 76 fire control system. Naval Ordnance Systems Command. N00017-67-C-0045.

30—**Control Data Corp.,** Minneapolis, Minn. $5,919,461. Design, development and fabrication of automatic formation drone control system for the Naval Weapons System, China Lake. Navy Purchasing Office, Los Angeles, Calif. N00123-69-C-0032.

—**Outboard Marine Corp.,** Waukegan, Ill. $1,471,730. Firefighting pumps. Galesburg, Ill. Navy Ships Parts Control Center, Mechanicsburg, Pa. N00104-68-C-7157.

—**General Precision Systems,** Little Falls, N.J. $1,258,600. An inertial measurement unit for the inertial measurement system used in the A-7E aircraft. Aviation Supply Office, Philadelphia, Pa. N00383-68-A-3201-0043.

DEPARTMENT OF THE AIR FORCE

1—**North American Rockwell Corp.,** Anaheim, Calif. $48,000,000. Production of Minuteman III guidance and control systems. Space & Missile Systems Organization, (AFSC), Los Angeles, Calif. F04701-68-C-0174.

—**Westinghouse Electric,** Baltimore, Md. $15,080,316. Replenishment of spare parts of an airborne radar system. Ogden Air Materiel Area, (AFLC), Hill AFB, Utah. F34601-68-A-0636-OP50.

—**Dow Chemical Co.,** Midland, Mich. $1,-502,247. Bombs. Ogden Air Materiel Area, (AFLC), Hill AFB, Utah. F42600-69-C-0191.

—**Lear Siegler, Inc.,** Grand Rapids, Mich. $1,068,388. Airborne navigation components. Aeronautical Systems Div., (AFSC), Wright-Patterson AFB, Ohio. F33657-68-C-0861-P00.

2—**United Aircraft,** East Hartford, Conn. $1,165,308. J57 and J75 aircraft engine spare parts. $1,006,406. T34 aircraft engine spare parts. San Antonio Air Materiel Area, (AFLC), Kelly AFB, Tex. N383-69-000A.

5—**Hazeltine Corp.,** Little Neck, N.Y. $1,-880,882. Production of receiver transmitter systems. Aeronautical Systems Div., (AFSC), Wright-Patterson AFB, Ohio. F33657-68-C-0610-P004.

—**Kollsman Instrument Corp.,** Syosset, N.Y. $1,080,000. An illustrated parts break-down for AN/USQ-28 mapping and survey subsystem. Aeronautical Systems Div., (AFSC), Wright-Patterson AFB, Ohio. F33657-68-C-1146.

—**Westinghouse Electric,** Baltimore, Md. $2,524,000. Production of electronic warfare equipment for F-4 aircraft. Aeronautical Systems Div., (AFSC), Wright-Patterson AFB, Ohio. F33657-67-C-0994.

—**I.B.M. Corp.,** Los Angeles, Calif. $1,-077,635. Depot level maintenance and logistic support of the SAGE computer system for FY 1969. Kingston, N.Y. Sacramento Air Materiel Area, (AFLC), McClellan AFB, Calif. F04606-68-C-0764.

6—**Curtiss Wright Corp.,** Wood-Ridge, N.J. $1,057,079. Production of blade assemblies for J-65 aircraft engines. San Antonio Air Materiel Area, (AFLC), Kelly AFB, Tex. F41608-67-A-5900.

8—**United Aircraft,** East Hartford, Conn. $1,199,201. Nozzles and forgings for J-57 aircraft engines. San Antonio Air Materiel Area, (AFLC), Kelly AFB, Tex. N383-69-000A.

—**American Electric, Inc.,** La Mirada, Calif. $3,551,688. Bomb production. Ogden Air Materiel Area, (AFLC), Hill AFB, Utah. F04606-68-A-0154-QP01.

12—**Hughes Aircraft,** Fullerton, Calif. $5,-872,158. Inclusion of automatic data link capability to tactical operations Centers. Electronic Systems Div., (AFSC), L. G. Hanscom Field, Mass. F19628-67-C-0154-P048.

13—**General Electric Aircraft Engine Group,** West Lynn, Mass. $6,646,400. Production of J85-GE-17A engines in support of A-37B aircraft. Aeronautical Systems Div., (AFSC), Wright-Patterson AFB, Ohio. F33657-67-C-1659-P017.

—**Lockheed Aircraft,** Marietta, Ga. $2,-195,409. Production of modification kits for C-141 aircraft. Warner Robins Air Materiel Area, (AFLC), Robins AFB, Ga. F09603-68-A-0325-0194.

—**Sun Electric Corp.**, Crystal Lake, Ill. $1,304,521. Hydraulic test stands for F–4 and F–100 aircraft. San Antonio Air Materiel Area, (AFLC), Kelly AFB, Tex. F41608–68–C–9633.

14—**Aerodex, Inc.**, Miami, Fla. $1,037,235. Overhaul of R3350 reciprocating aircraft engines. San Antonio Air Materiel Area, (AFLC). Kelly AFB, Tex. F41608–68–D–0645–P034.

—**Aerodex, Inc.**, Miami, Fla. $1,071,463. Overhaul of R4360 reciprocating aircraft engines. San Antonio Air Materiel Area, (AFLC), Kelly AFB, Tex. F41608–68–D–0616–P021.

—**Lenkurk Electric Co.**, San Carlos, Calif. $1,576,500. Production of communications equipment. Oklahoma City Air Materiel Area, (AFLC), Tinker AFB, Okla. F34601–69–G–0357.

—**Motorola, Inc.**, Scottsdale, Ariz. $7,649,474. Bomb fuzes. Aeronautical Systems Div., (AFSC), Wright-Patterson AFB, Ohio. F33657–69–C–0237.

15—**Sylvania Electric Products**, Mountain View, Calif. $1,320,000. Depot level overhaul manuals. Aeronautical Systems Div., (AFSC), Wright-Patterson AFB, Ohio. AF33(657)–14055.

—**Lenkurt Electric Co.**, San Carlos, Calif. $1,514,700. Production of communication multiplex equipment. Oklahoma City Air Materiel Area, (AFLC), Tinker AFB, Okla. F34601–68–C–4701.

—**General Electric**, Burlington, Vt. $1,206,264. Spare parts for aircraft armament. Warner Robins Air Materiel Area, (AFLC), Robins AFB, Ga. F09603–67–A–0344.

16—**Service Technology Corp.**, Dallas, Tex. $11,498,970. Conversion of range telemetry systems. Aeronautical Systems Div., (AFSC), Wright-Patterson AFB, Ohio. F19628–68–C–0195.

—**Philco-Ford Corp.**, Palo Alto, Calif. $2,000,000. Work on ejection equipment for re-entry vehicles. Space & Missile Systems Organization, (AFSC), Los Angeles, Calif. F04701–69–C–0110.

19—**Dynamics Corp. of America**, Bridgeport, Conn. $2,972,937. Production of MB generator sets. Sacramento Air Materiel Area, (AFLC), McClellan AFB, Calif. F04606–68–D–0575.

—**Modulux, Inc.**, Newark, Calif. $2,642,960. Production of relocatable buildings. Warner Robins Air Materiel Area, (AFLC), Robins AFB, Ga. F09603–68–C–2820–P002.

—**AVCO Corp.**, Richmond, Ind. $2,000,000. Production of bomb fuse assemblies. Aeronautical Systems Div., (AFSC), Wright-Patterson AFB, Ohio.

20—**Batesville Mfg. Co.**, Camden, Ark. $2,000,370. Production of aircraft munitions. Aeronautical Systems Div., (AFSC), Wright-Patterson AFB, Ohio. F33657–69–C–0284.

21—**Batesville Mfg. Co.**, Batesville, Ark. $2,520,000. Bomb components. Aeronautical Systems Div., (AFSC), Wright-Patterson AFB, Ohio. F33657–69–C–0164.

—**Litton Systems**, Van Nuys, Calif. $1,432,710. Ground radar components. Salt Lake City, Utah. Sacramento Air Materiel Area (AFLC), McClellan AFB, Calif. F04606–68–A–0193.

22—**Cessna Aircraft Co.**, Wichita, Kan. $3,910,000. Production of A–37 aircraft. Aeronautical Systems Div., (AFSC), Wright-Patterson AFB, Ohio. F33657–69–C–0079.

—**ITT**, Nutley, N.J. $3,240,894. Production of spare parts for a radio navigational system (LORAN-D AN/ARN–92). Warner Robins Air Materiel Area, (AFLC), Robins AFB, GA. F33657–67–C–0524.

23—**United Aircraft**, Hartford, Conn. $1,010,782. Production of spare parts for J–57 aircraft engines. San Antonio Air Materiel Area, (AFLC), Kelly AFB, Tex. N383–69–000A.

—**Atlantic Research Corp.**, Costa Mesa, Calif. $4,765,000. Manufacture and launch of 30 Athena H missiles in support of advanced ballistic reentry systems. Space & Missile Systems Organization, (AFSC), Los Angeles, Calif. F04701–68–C–0046.

26—**LTV Electrosystems**, Salt Lake City, Utah. $2,612,330. Manufacture of communications test equipment. Oklahoma City Air Material Area, (AFLC), Tinker AFB, Okla.

—**Boeing Co.**, Seattle, Wash. $1,300,000. Engineering support for a missile silo program. Space & Missile Systems Organization, (AFSC), Norton AFB, Calif.

—**Overseas National Airways**, Jamaica, N.Y. $10,504,892. Domestic cargo air transportation. Military Airlift Command.

—**Universal Airlines**, Ypsilanti, Mich. $5,028,416. Domestic cargo air transportation. Military Airlift Command.

—**World Airways**, Oakland, Calif. $2,693,151. Domestic cargo air transportation. Military Airlift Command.

—**Saturn Airways, Inc.**, Oakland, Calif. $6,127,352. Domestic cargo air transportation. Military Airlift Command.

—**Universal Airlines**, Ypsilanti, Mich. $9,913,669. Support of the Navy Quicktrans system. Military Airlift Command.

27—**McDonnell Douglas Corp.**, Tulsa, Okla. $1,080,500. Inspection, repair, and modification of B–66 aircraft. Warner Robins Air Materiel Area, (AFLC), Robins AFB, GA. F09603–69–C–0582.

—**United Aircraft**, West Palm Beach, Fla. $11,000,000. Initial engineering development for the Air Force FX/Navy VFAX engine. Aeronautical Systems Div., (AFSC), Wright-Patterson AFB, Ohio. 69–C–0060.

—**General Electric**, Cincinnati, Ohio. $11,000,000. Initial engineering development for the Air Force FX/Navy VFAX engine. Aeronautical Systems Div., (AFSC), Wright-Patterson AFB, Ohio. 69–C–0060.

28—**ITT-Gilfilan**, Van Nuys, Calif. $1,850,000. Radar equipment. Oklahoma City Air Materiel Area, (AFLC), Tinker AFB, Okla. F34601–69–C–0331.

—**Libby Welding Co.**, Kansas City, Mo. $2,371,678. Generator sets. Sacramento Air Materiel Area, (AFLC), McClellan AFB, Calif. F04606–68–D–0135 (0003).

—**Cryogenic Engineering Co.**, Denver, Colo. $1,046,680. Liquid oxygen tanks. San Antonio Air Materiel Area, (AFLC), Kelly AFB, Tex. F41608–68–D–79094.

29—**Sanders Associates**, Bedford, Mass. $9,467,824. Production of proximity fuses. Aeronautical Systems Div., (AFSC), Wright-Patterson AFB, Ohio. F33657–69–C–0335.

—**General Motors**, Indianapolis, Ind. $4,677,800. Procurement of T–56 turboprop aircraft engines. Aeronautical Systems Div., (AFSC), Wright-Patterson AFB, Ohio. F33657–69–C–0180.

—**Kaman Corp.**, Bloomfield, Conn. $2,207,068. Replacement spare parts for HH–43 helicopters. Warner Robins Air Materiel Area, (AFLC), Robins AFB, Ga. F09603–69–C–0524.

30—**Electronic Communications**, St. Petersburg, Fla. $1,050,000. C–135 aircraft communication equipment. Oklahoma City Air Materiel Area, (AFLC), Tinker AFB, Okla. F09603–68–A–0211.

—**M.I.T.**, Cambridge, Mass. $25,943,000. General research and space communications support. Electronics Systems Div., (AFSC), L. G. Hanscom Field, Mass. AF19 (628) 5167.

—**Holmes & Narver, Inc.**, Los Angeles, Calif. $1,687,020. Maintenance and operation equipment for the Point Barrow Navy Research Site, Alaska. Alaskan Air Command. AF65517–69–C–0001.

OFFSHORE PROCUREMENT

5—**Canadian Commercial Corp.**, Ottawa, Ontario, Canada. $3,871,400. Non-personal services, data and logistic support for FY 1969 operation and maintenance of the USAF-Canadian Northeast Wideband Systems and depot level maintenance of Pinetree East electronic and ancillary equipment. Sacramento Air Materiel Area, (AFLC), McClellan AFB, Calif.

Proposals Asked for Army Automatic Cannon

The U.S. Army Weapons Command, Rock Island, Ill., has announced that competitive proposals from industry will be open this fall for development of a new automatic cannon.

Nicknamed "Bushmaster," the new weapon will be employed on a new family of Army combat vehicles and will be the successor to some .50 caliber machine guns and the M139 20mm gun.

It is anticipated that successful contractors will be awarded initial contracts in early 1969. Production is scheduled for the mid-1970s.

The Bushmaster system will include the new automatic cannon, ammunition, and feed system. It is expected that the new cannon will be 20mm or larger. The new system will permit the gunner to select the type ammunition which will be most effective against the target.

Lieutenant Colonel Patrick H. Lynch, Project Manager for Vehicle Rapid Fire Weapons Systems, at the Army Materiel Command, is charged with the responsibility for development of the Bushmaster.

Army Opens Research Liaison Offices

The Army Combat Developments Command (CDC) has established a Research and Industry Liaison Office (RILO) at its Fort Belvoir, Va., headquarters, and a branch in the Federal Building, Los Angeles, Calif.

A booklet on its operations is available from RILO, Headquarters, U.S. Army Combat Developments Command, Fort Belvoir, Va. 22060.

Changing Address?

The *Defense Industry Bulletin* converted to a computer-prepared mailing list a few months ago. Now, when requesting a change in address or a deletion, subscribers must send the mailing label from the back cover of the magazine. Without this label, changes in address or deletions cannot be effected. Changes and labels should be sent to the Editor, Defense Industry Bulletin, OASD (Public Affairs), Room 1E764, The Pentagon, Washington, D.C. 20301.

DOD Launches RDT&E Program To Upgrade Military Food Service

A single, coordinated and viable food research, development, test and engineering (RDT&E) program will be formulated and executed by the Defense Department to continually upgrade the general and specialized military feeding programs, and to meet feeding requirements as they change with the changing modes of warfare.

DOD Instruction 3200.10, "Research, Development, Testing and Engineering for the DOD Food Program," dated July 12, 1968, establishes policy and assigns responsibility for the program in DOD. The instruction includes, but is not limited to, the following elements of food service:

- Nutritional requirements and adequacy under all conditions.
- Food chemistry, microbiology, processing, preservation, packaging, stability and consumer acceptance.
- Food preparation, holding, serving and handling equipment.
- Food service systems, materiel and facilities for all environments and all operating conditions.
- Recipes, menus, operational rations, and food packets.
- Specifications data for food and related packaging, equipment and systems.

Under the new instruction, the Director of Defense Research and Engineering (DDR&E) is responsible for supervising and monitoring the food RDT&E program. The Assistant Secretary of Defense (Installations and Logistics) is responsible for insuring that the output of the RDT&E program is properly integrated into the Uniform Food Service Program, and making recommendations for research and development programs.

Responsibility for the formulation of the DOD food RDT&E program, subject to the approval of DDR&E, is assigned to the Secretary of the Army.

The Army will execute the approved program in coordination with the other Military Departments and appropriate DOD components. The individual Services will propose to the Army RDT&E projects for which there are unique requirements for incorporation into the overall DOD program.

New AFSC Center Organized at Eglin AFB, Fla.

A new element of the Air Force Systems Command (AFSC) has been established at Eglin AFB, Fla., called the Armament Development and Test Center (ADTC).

Concurrent with the organization of ADTC, the Air Proving Ground Center (APGC) at Eglin AFB was discontinued. Major General A. J. Kinney, who had commanded APGC, now commands the new center.

ADTC will be responsible for the Air Force non-nuclear munitions program, including initial acquisition, engineering development, test, evaluation and program management.

Major mission elements of the center will be the Directorate of Engineering, the Directorate of Test and Evaluation, and the Directorate of Acquisition. Personnel involved in initial munitions acquisition functions, now assigned to the Aeronautical Systems Division at Wright-Patterson AFB, Ohio, will be transferred to ADTC. The Air Force Armament Laboratory at Eglin will continue to function under AFSC headquarters, but will work closely with ADTC.

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